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TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

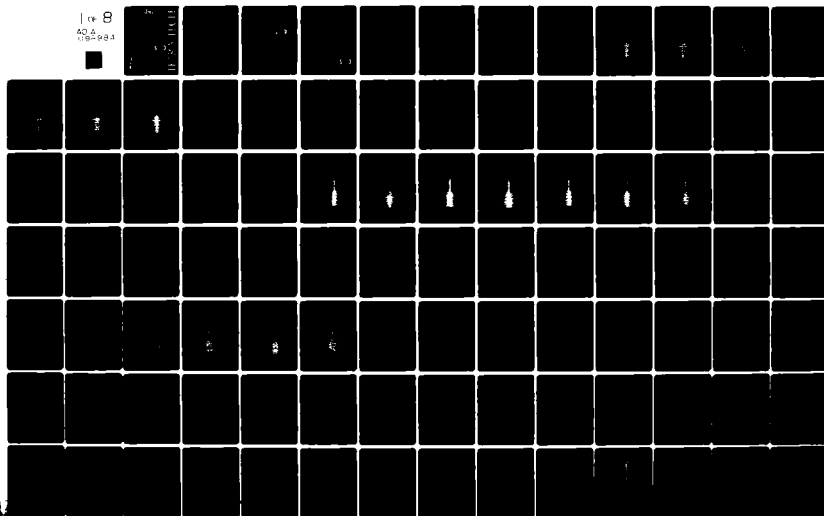
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TETRA-T-3925-APP-A(1)

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1 of 8  
AD-A  
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**LEVEL III**



**COLUMBIA RIVER ENTRANCE  
CHANNEL DEEP-DRAFT VESSEL  
MOTION STUDY**

**FINAL REPORT**

**AD A098984**

**APPENDIX A**

**PHASE I DATA**

**DTIC  
ELECTE  
MAY 15 1981**

**TETRA TECH REPORT NO. TC-3925**

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	AD-A098984	9
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED
Columbia River Entrance Channel Deep-Draft Vessel Motion Study, <del>Final Report</del> Appendix A.		Final Report Dec. 78- Sep 80. <i>Process 1.</i>
6. AUTHOR(s)		7. PERFORMING ORG. REPORT NUMBER
Shen Wang Michael Kimble Chris Butcher Glenn D. Cox		Tetra Tech Report #TC-3925
8. CONTRACT OR GRANT NUMBER(s)		
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
Tetra Tech, Inc. 630 N. Rosemead Blvd. Pasadena, CA 91107		421A-1
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
Department of the Army Portland District, Corps of Engineers, NPPEN-PL-2 P.O. Box 2946, Portland, Oregon 97208		11 September 1980
13. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		14. NUMBER OF PAGES
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Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
Presented at ASCE National Convention, 14-18 April 1980 in Portland, Oregon. (Preprint 80-160).		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Ship Motion, Water Wave Action on Ships, Approach Channels, Entrance Channels, Columbia River.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
A prototype ship motion monitoring program was initiated by the Portland District, U.S. Army Corps of Engineers to provide design criteria for the entrance channel at the mouth of the Columbia River. The contractor's field team boarded deep draft vessels bound to or from the Columbia River and measured vertical acceleration (heave), pitch, roll, yaw, and position as the vessels transited the 5-mile entrance channel. Twenty-nine vessels were monitored in the period May 1978-March 1979, and twenty-four in the period October 1979-April 1980.		

(OVER)



SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

The final report details the field work data reduction processes, analyses, and results. The raw data is used to calculate vertical motions at the bow, stern, and side of the vessel, and the horizontal motion as the ship transits the entrance. This information is evaluated with respect to environmental conditions and the channel. Results of statistical analyses are shown for characteristics of individual transits, and long-range entrance usage.

Appendices A-K contain the tabulated and plotted motion data, environmental conditions, ship motion variables, and other information collected.

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APPENDIX A  
RECORDED AND PROCESSED DATA  
COMPILED BY VOYAGES

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Following is a voyage by voyage summary of the data analysis results. Included for each voyage is a tabulation of the statistics, and ship trajectory, time series and cumulative frequency plots. The statistics are presented first and are self-explanatory. Following is the ship trajectory plot which shows the track of the ship through the channel and the time of day at which the voyage started. The small tic marks on the track indicate one minute intervals while the large tic marks indicate five minute intervals. The time series plots are presented next and can be correlated with the trajectory plots so that the motions can be related to the ship position in the channel. Finally, the cumulative frequency plots, which represent the probability of a motion to exceed a given magnitude, are presented. For many of the voyages a 2 or 5 minute interval of the total time series plot is presented on an expanded scale.

As indicated in the text, the processing time for statistical analysis varies from voyage to voyage. The time intervals which the data analysis apply as well as the total data recording times for the 29 voyages are summarized in the following page.



TIME INTERVALS OF DATA RECORDING  
AND DATA PROCESSING FOR EACH TRANSIT

VOYAGE NO.	RECORDING TIME		TOTAL RECORDING TIME	PROCESSING TIME		TOTAL PROCESSING TIME	REMARKS
	BEGINNING	END		BEGINNING	END		
1	20:49:00	21:14:16	25m 16s	20:49:00	21:03:00	14m 00s	
2	15:29:00	15:52:59	23m 59s	15:29:00	15:41:30	12m 30s	
3	19:04:01	19:27:29	23m 28s	19:04:01	19:15:01	11m 00s	
4	16:58:00	17:23:48	25m 48s	17:07:00	17:20:00	13m 00s	
5	12:01:03	12:24:59	23m 56s	12:02:03	12:15:45	13m 42s	
6	09:44:02	10:13:00	31m 58s	09:53:02	10:06:03	13m 00s	
7	21:38:05	22:02:00	23m 55s	21:48:05	21:59:35	11m 30s	
8	13:50:00	14:16:58	26m 58s	13:50:00	14:08:00	18m 00s	
9	08:56:00	09:19:02	23m 02s	09:04:18	09:19:02	14m 44s	
10	05:15:00	05:37:59	22m 59s	05:15:00	05:29:30	14m 30s	
11	14:26:01	14:45:03	19m 02s	14:33:31	14:45:03	11m 32s	
12	13:13:00	13:38:59	25m 59s	13:14:00	13:30:00	16m 00s	
13	05:24:00	05:50:59	26m 59s	05:25:00	05:41:30	16m 30s	
14	15:21:00	15:48:58	27m 58s	15:31:00	15:48:58	17m 58s	
15	05:38:00	06:11:58	33m 58s	05:39:36	06:04:30	24m 54s	DATA GAP FROM 06:02:33 to 06:02:40
16	14:36:30	15:09:59	33m 29s	14:43:00	15:09:59	26m 59s	
17	23:44:03	00:04:56	20m 53s	23:46:03	23:57:03	11m 00s	DATA GAP FROM 23:45:45 to 23:49:05
18	06:43:04	07:09:01	25m 57s	06:48:04	06:58:34	10m 30s	
19	07:14:09	07:46:59	32m 50s	07:21:09	07:40:09	19m 00s	
20	00:31:17	00:49:59	18m 42s	00:31:17	00:42:17	11m 00s	
21	07:44:00	08:05:56	21m 56s	07:47:00	07:58:00	11m 00s	
22	05:15:03	05:42:56	27m 53s	05:23:03	05:33:03	10m 00s	
23	23:12:02	23:32:58	20m 56s	23:17:02	23:27:02	10m 00s	
24	09:39:08	09:56:57	17m 49s	09:39:08	09:52:08	13m 00s	
25	21:42:00	22:02:58	20m 58s	21:42:00	21:54:30	12m 30s	
26	12:33:00	12:49:57	16m 57s	12:37:00	12:45:00	8m 00s	
27	23:05:00	23:25:58	20m 58s	23:05:00	23:18:36	13m 36s	
28	04:33:00	04:56:57	23m 57s	04:34:00	04:49:30	15m 30s	
29	08:35:02	09:09:58	34m 56s	08:44:44	09:09:58	25m 14s	



# STATISTICAL SUMMARY

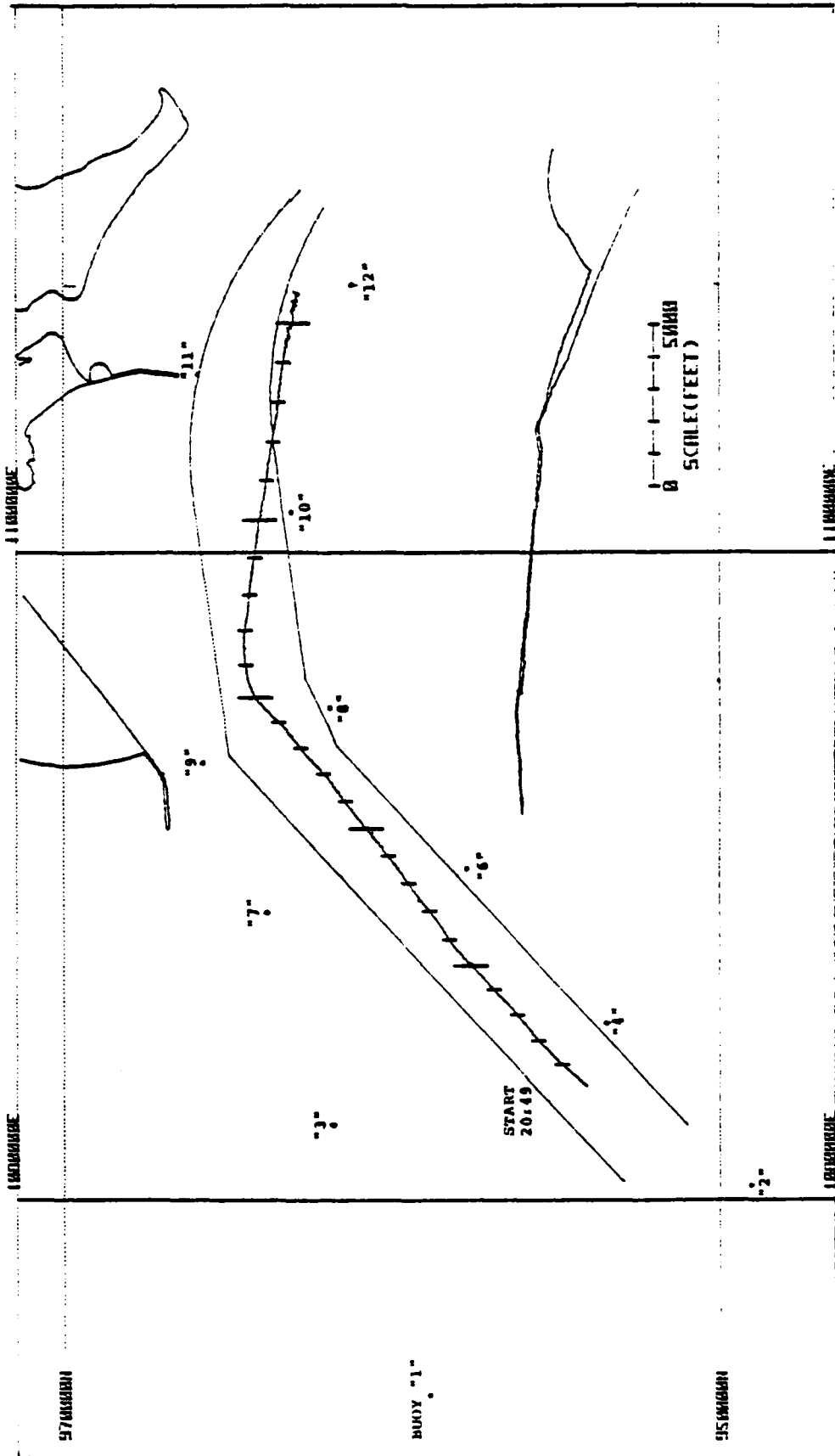
VOYAGE NO. 01

	HEAVY LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.3	2.5	.9	1.0
ROLL (DEG)	1.5	6.4	2.7	2.9
NO. (FT/SEC/SEC)	-.1	2.4	1.2	1.3
HEAVE (FT)	.1	7.0	2.6	2.9
RON EXCUR. (FT)	.1	20.2	7.3	8.0
STEER EXCUR. (FT)	.1	7.6	3.2	3.6
YIDE EXCUR (FT)	.1	9.0	3.7	4.1



# VUYHBE NO. 01 SHIP TRACK

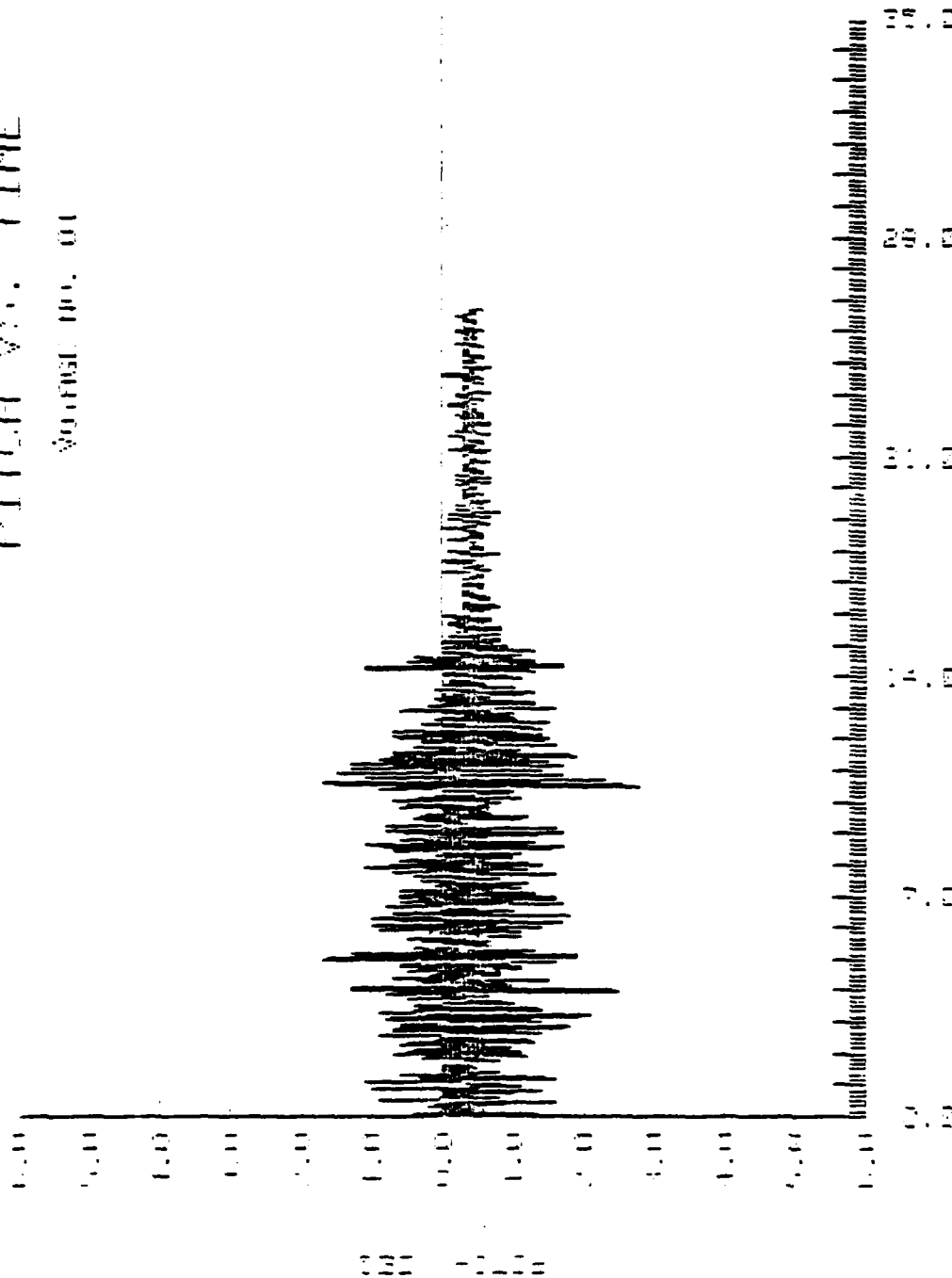
SCHE 1: 20000





# PITCH VOLT. TIME

VOLUME 100. 01

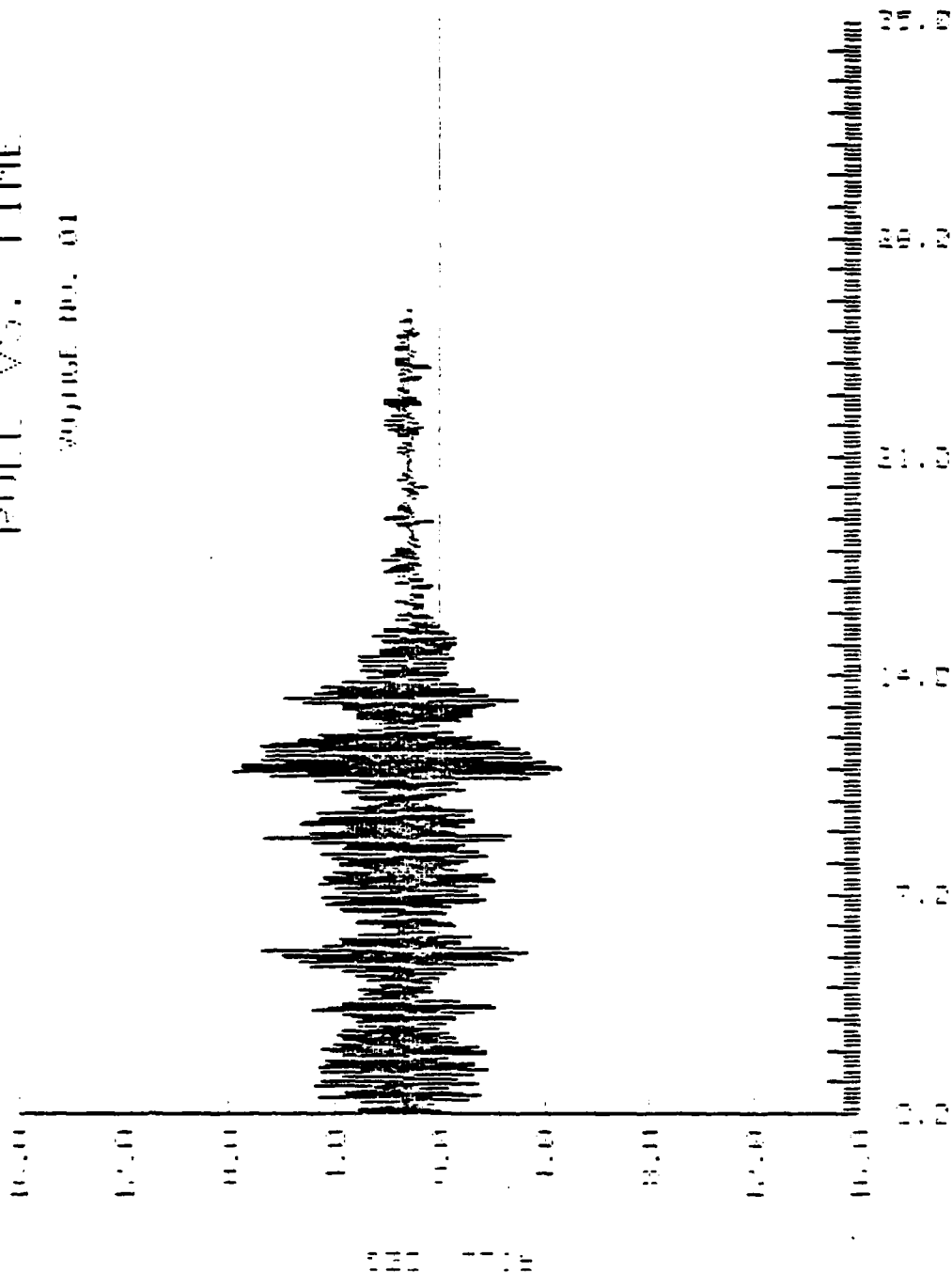


TIME 0.0100



# POLL VS. TIME

W0106 100. 01

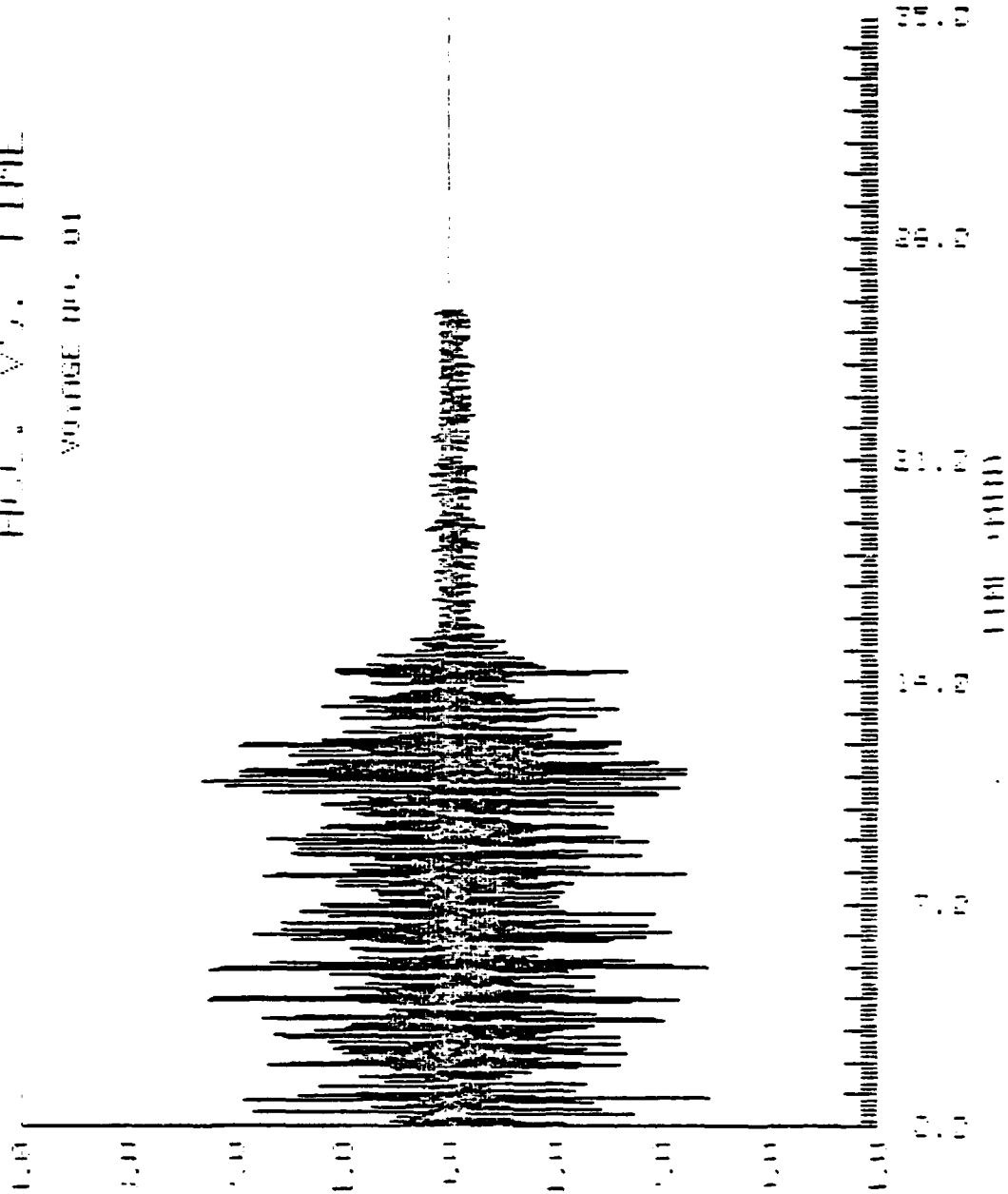


W0106 100. 01



# FILE V. TIME

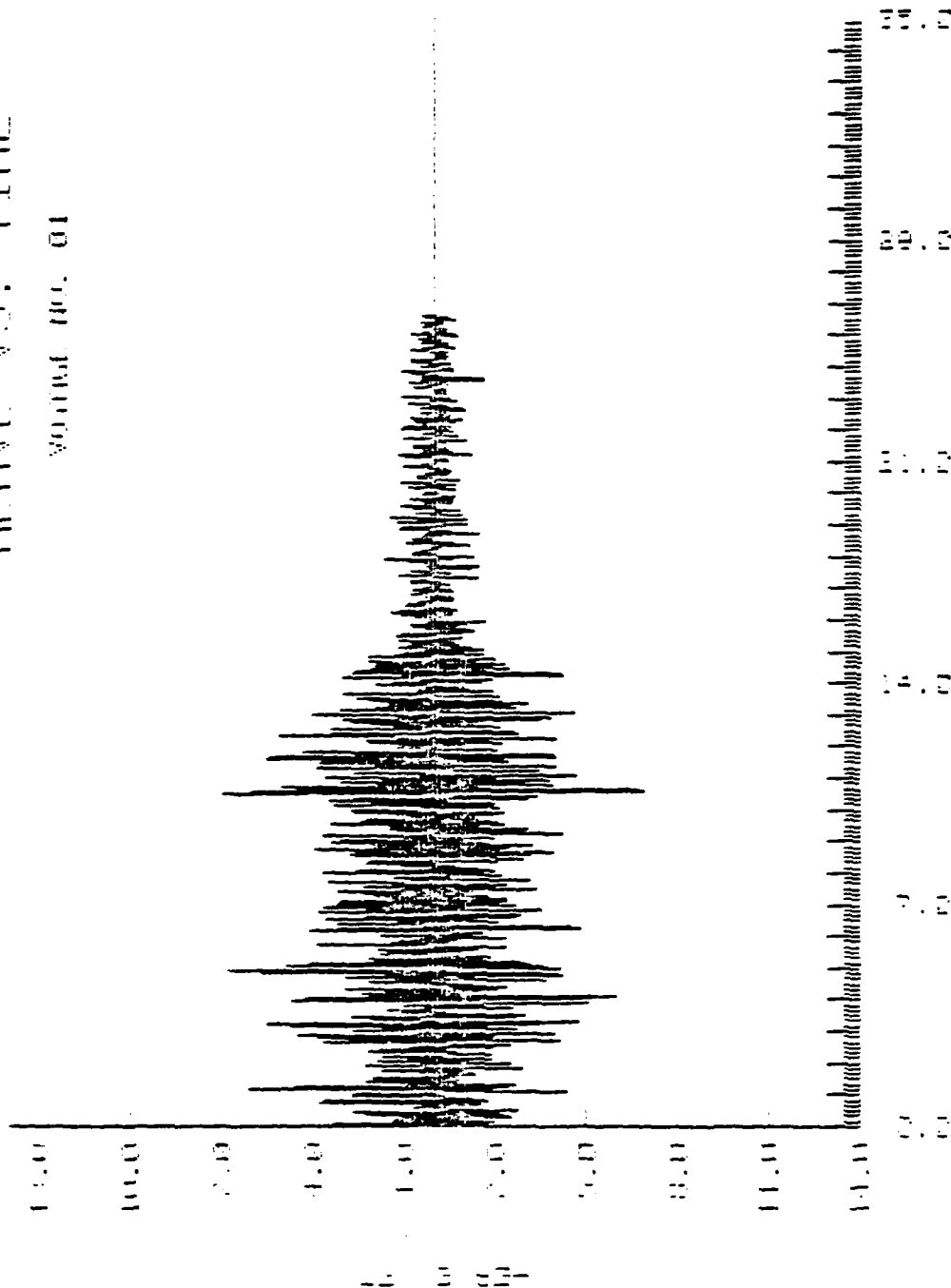
VOICE NO. 01





# RELATIVE VOLUME TIME

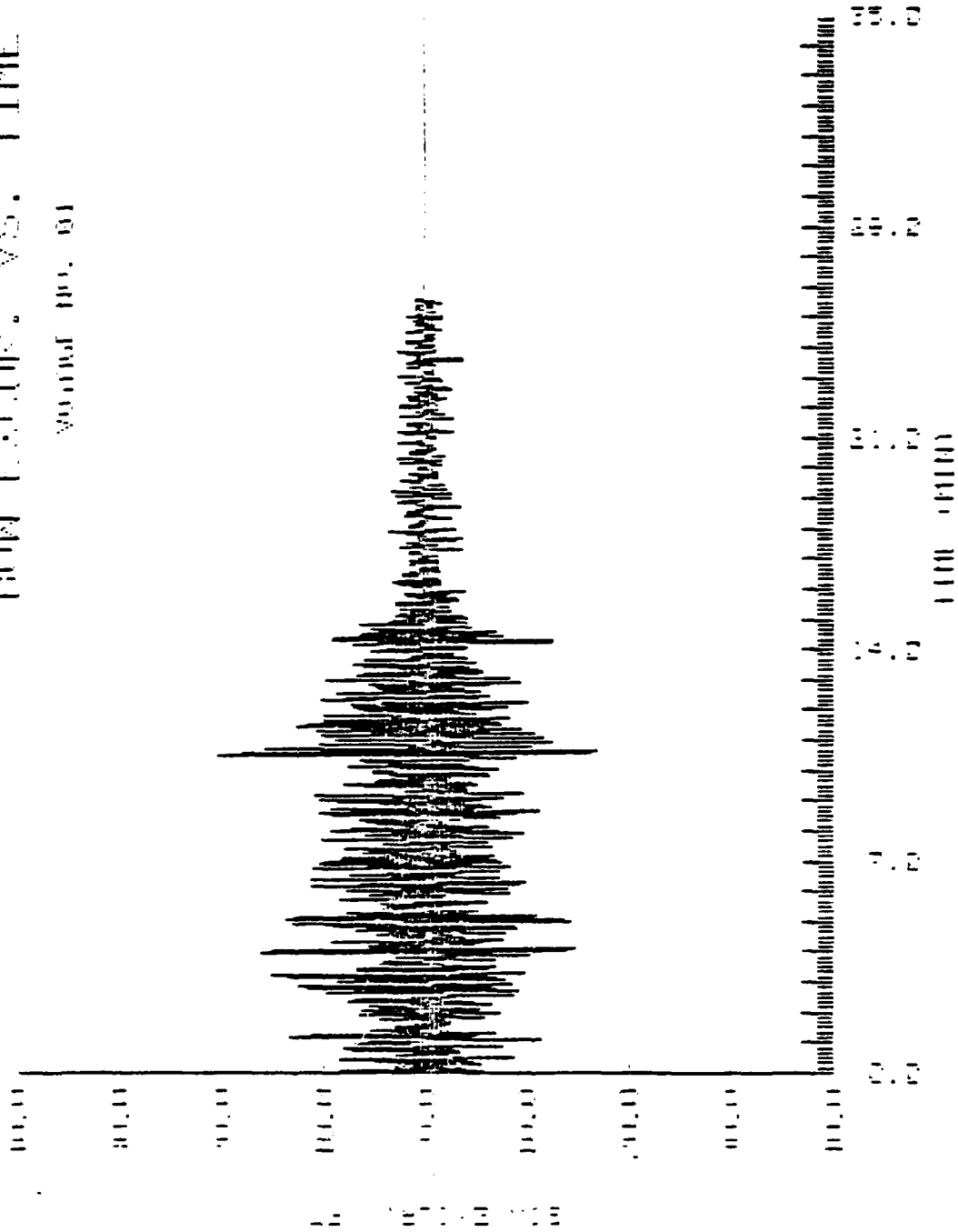
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# LOW FREQUENCY VS. TIME

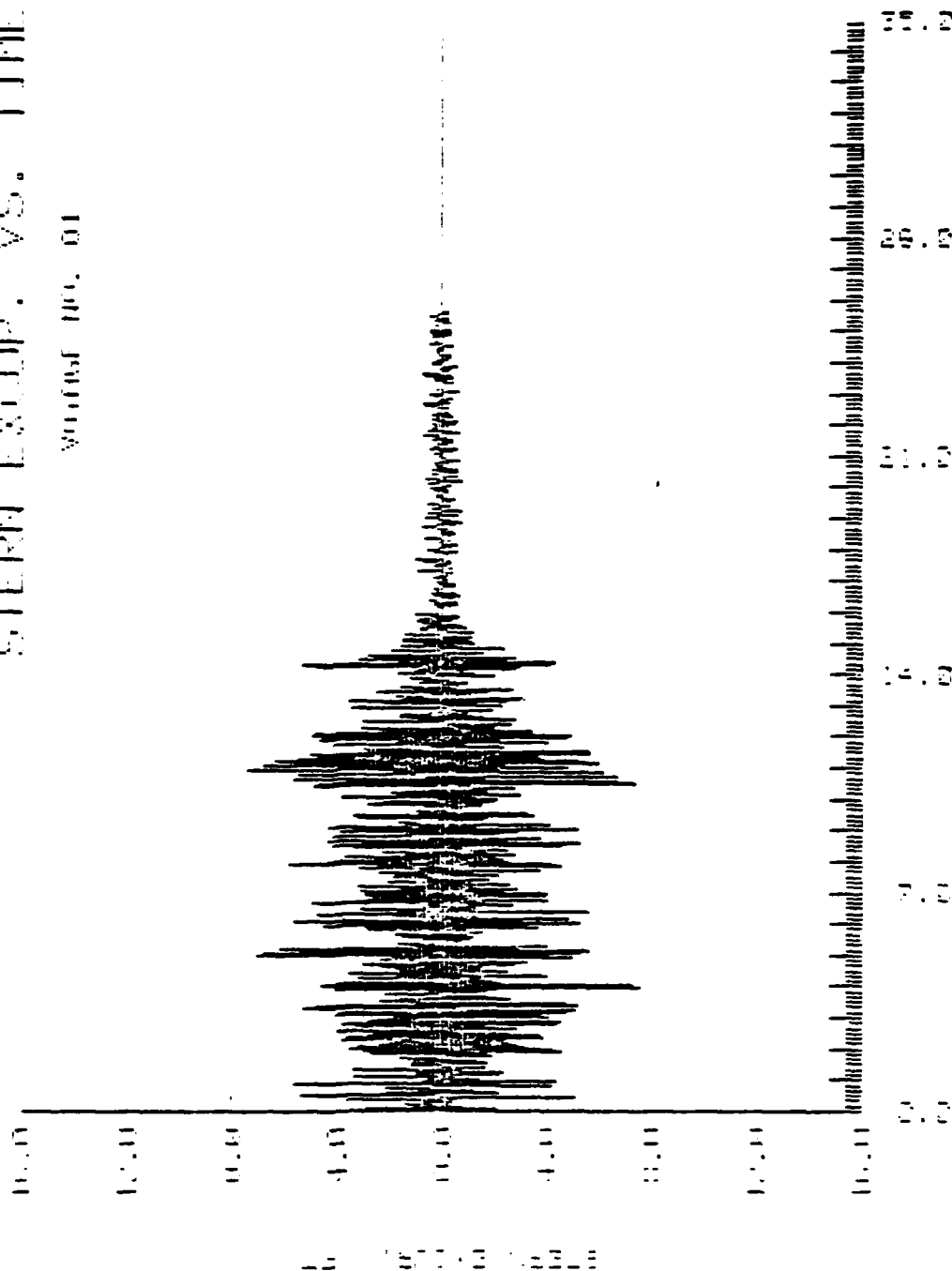
WIND NO. 01





# STERN EXCIP. VS. TIME

Wavelength 100.01

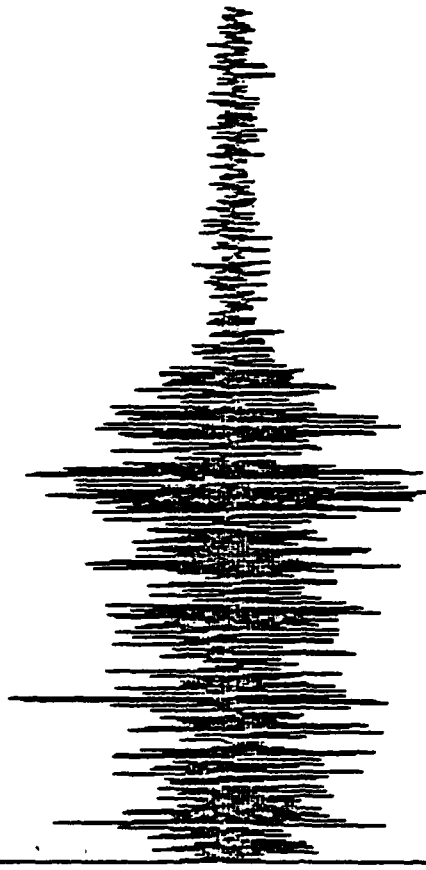




# SINE EXCUP. VS. TIME

WAVE NO. 01

10.00  
9.00  
8.00  
7.00  
6.00  
5.00  
4.00  
3.00  
2.00  
1.00  
0.00  
-1.00  
-2.00  
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-6.00  
-7.00  
-8.00  
-9.00  
-10.00

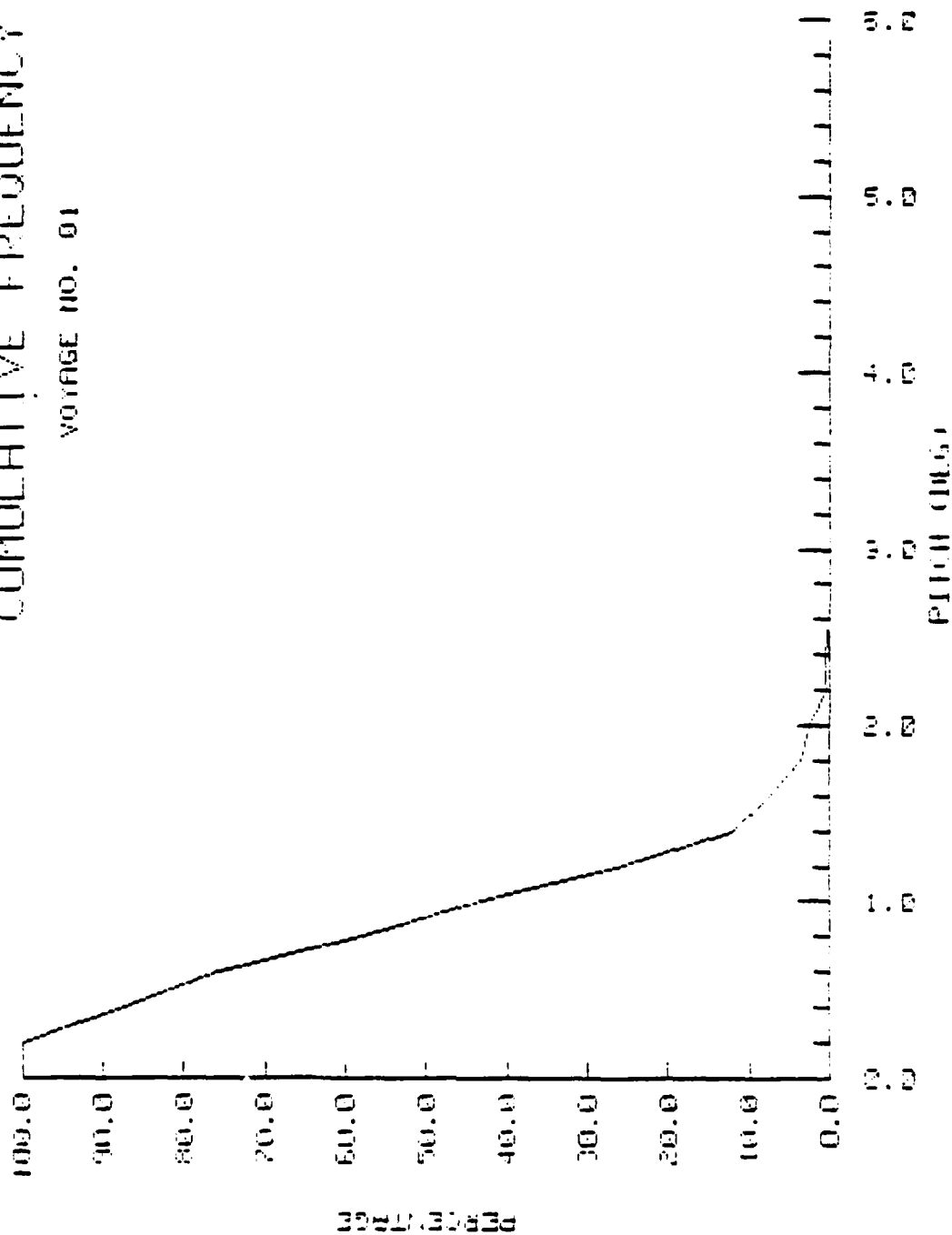


10.00  
9.00  
8.00  
7.00  
6.00  
5.00  
4.00  
3.00  
2.00  
1.00  
0.00  
-1.00  
-2.00  
-3.00  
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-9.00  
-10.00



# CUMULATIVE FREQUENCY

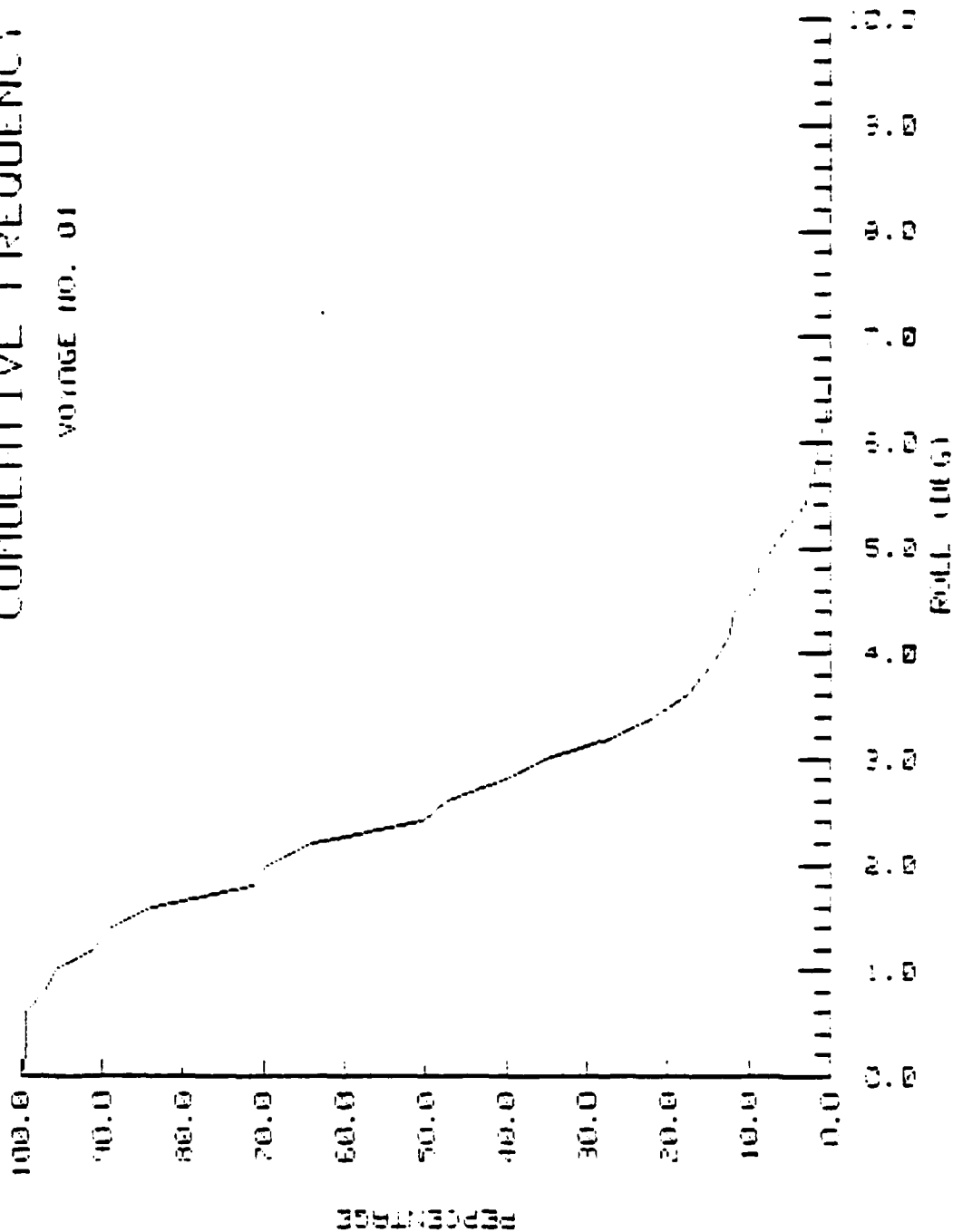
VOTAGE NO. 01





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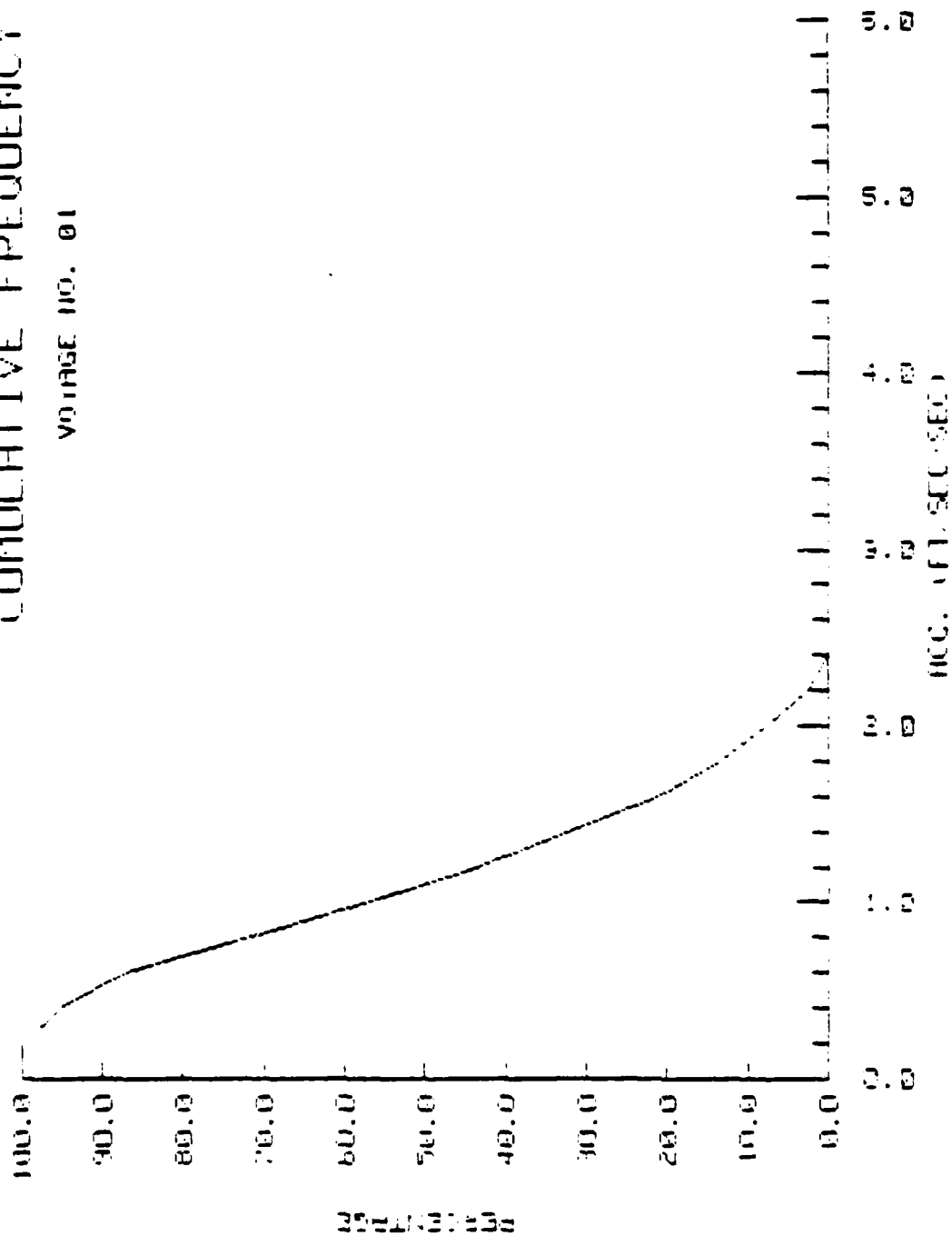
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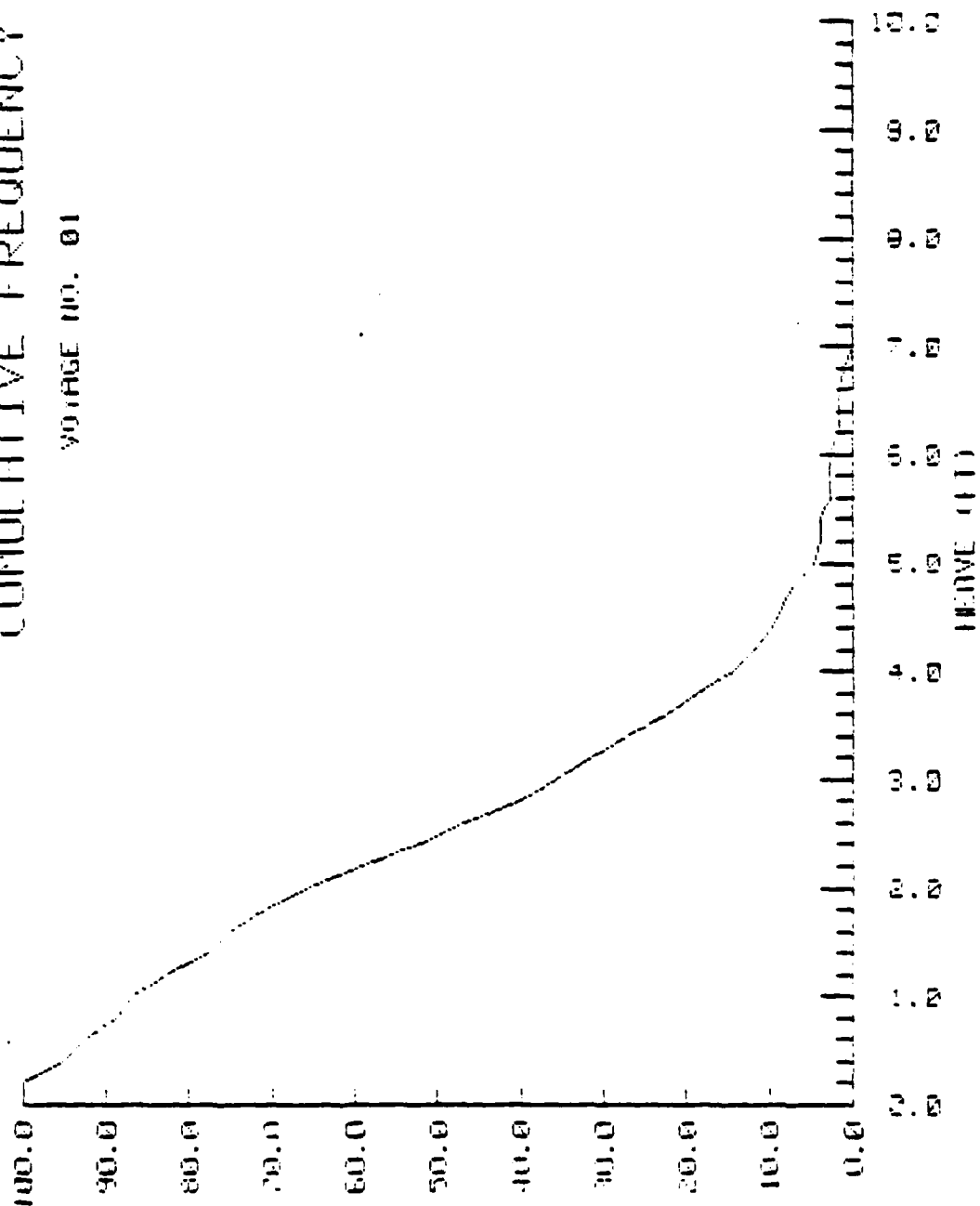
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VOLAGE NO. 01

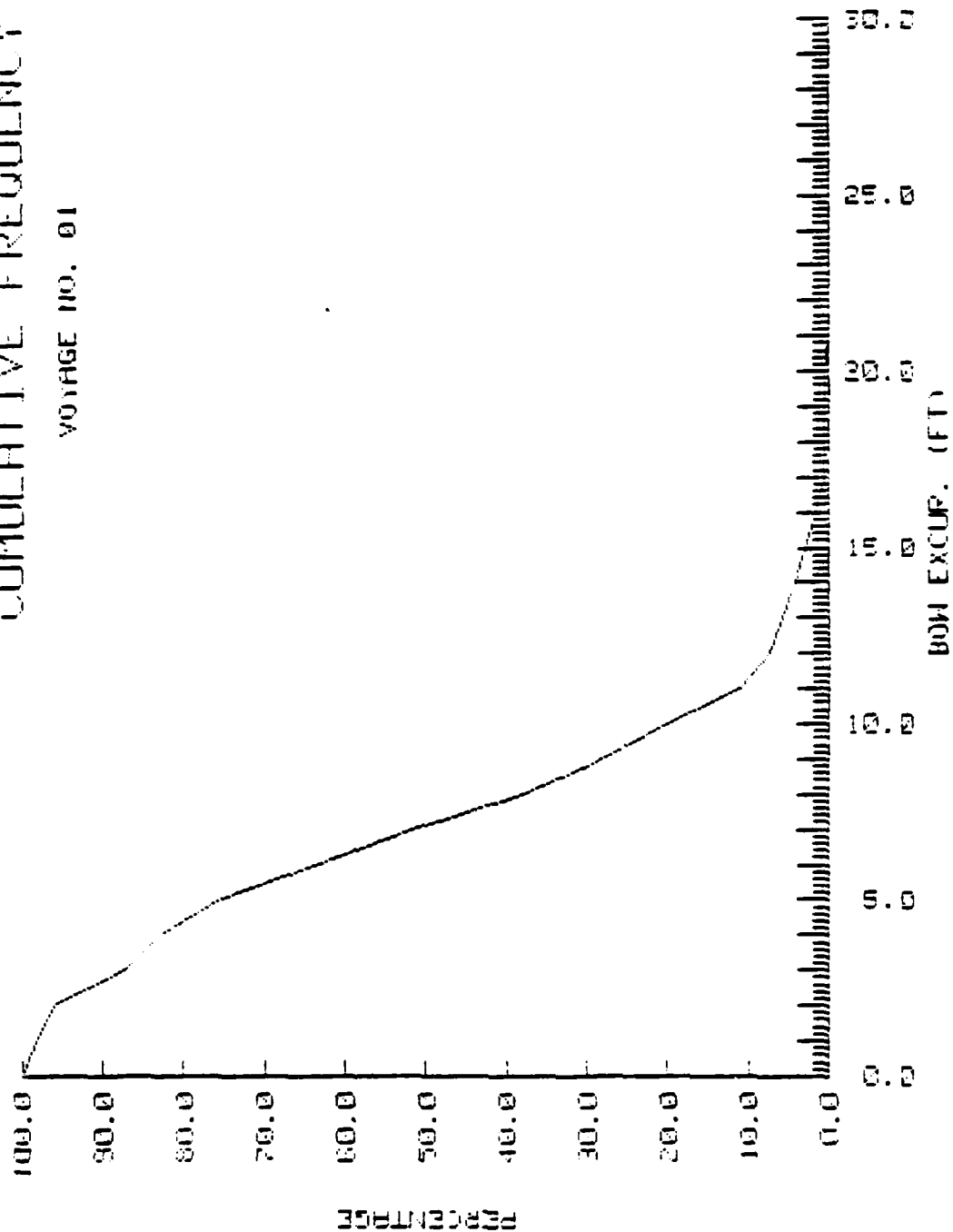


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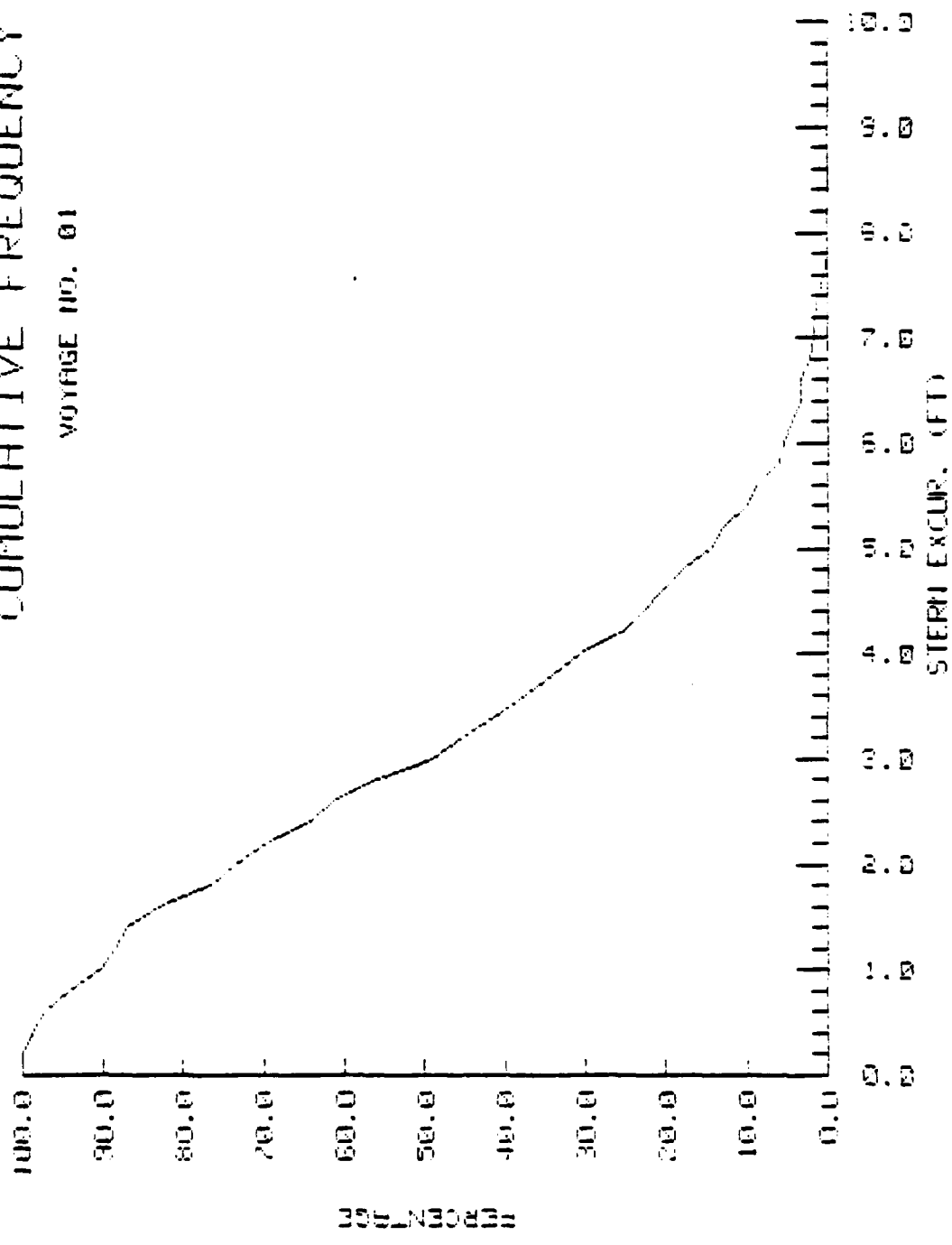
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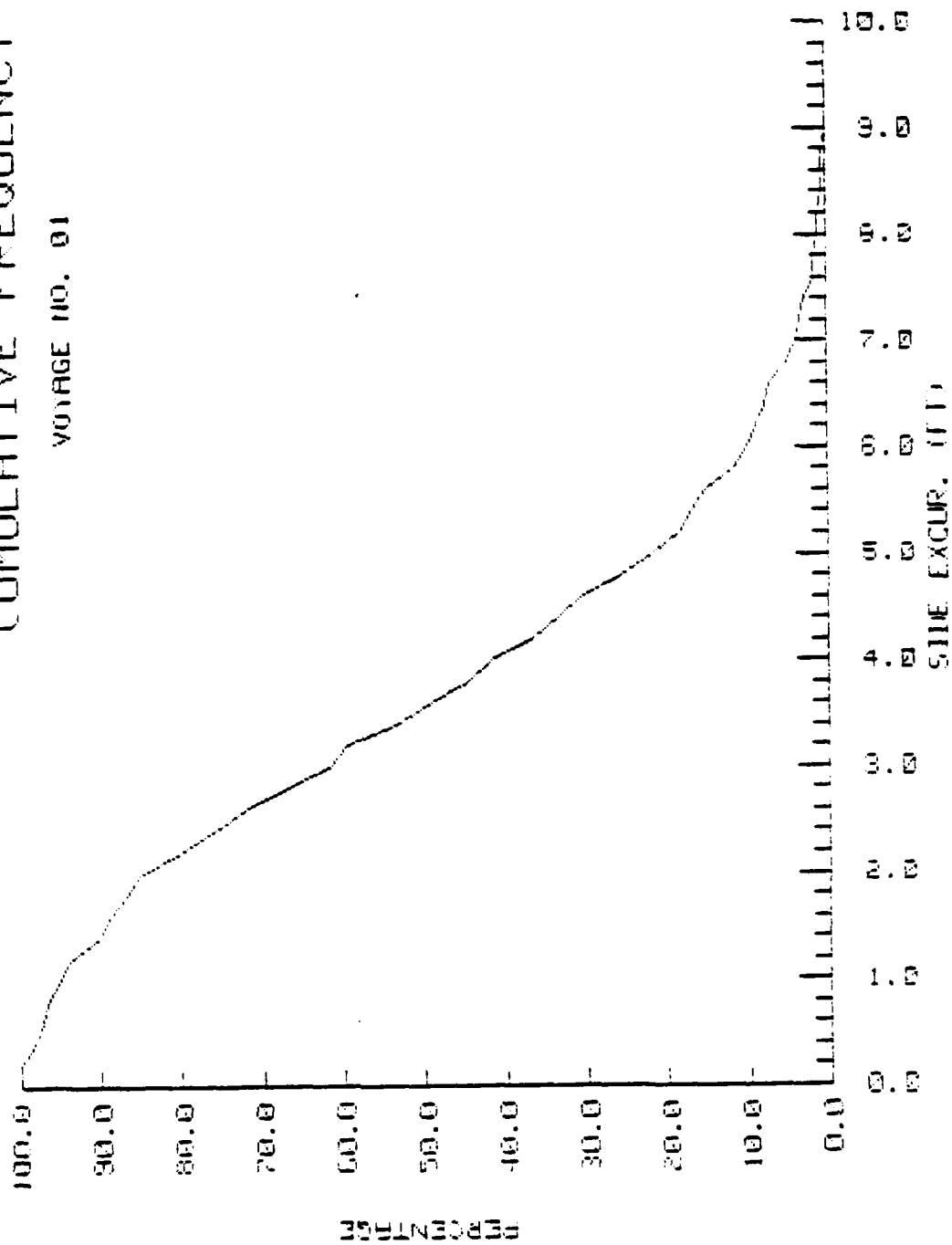
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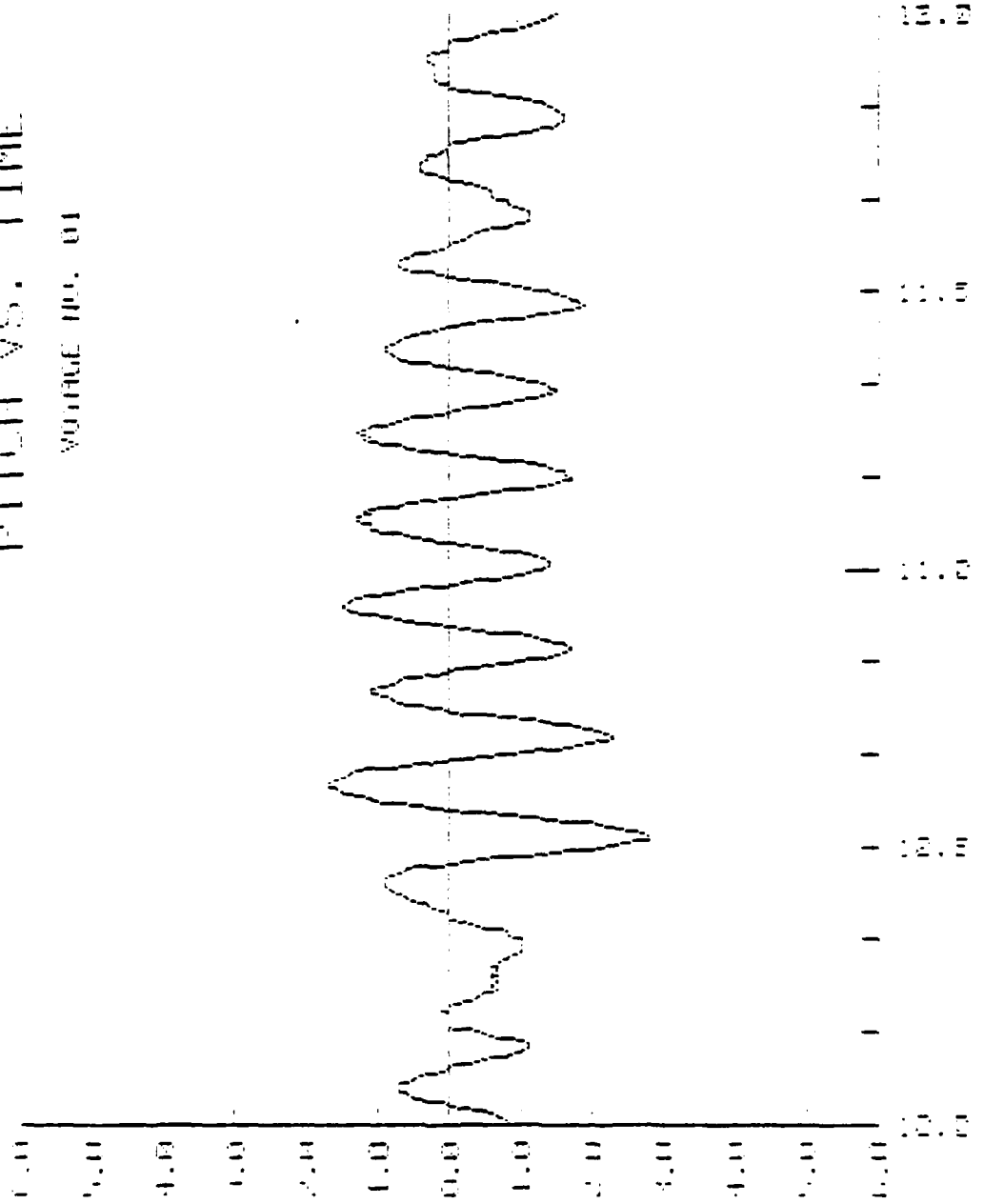
VOLAGE NO. 01





# PITCH VS. TIME

VOLUME 100, 01

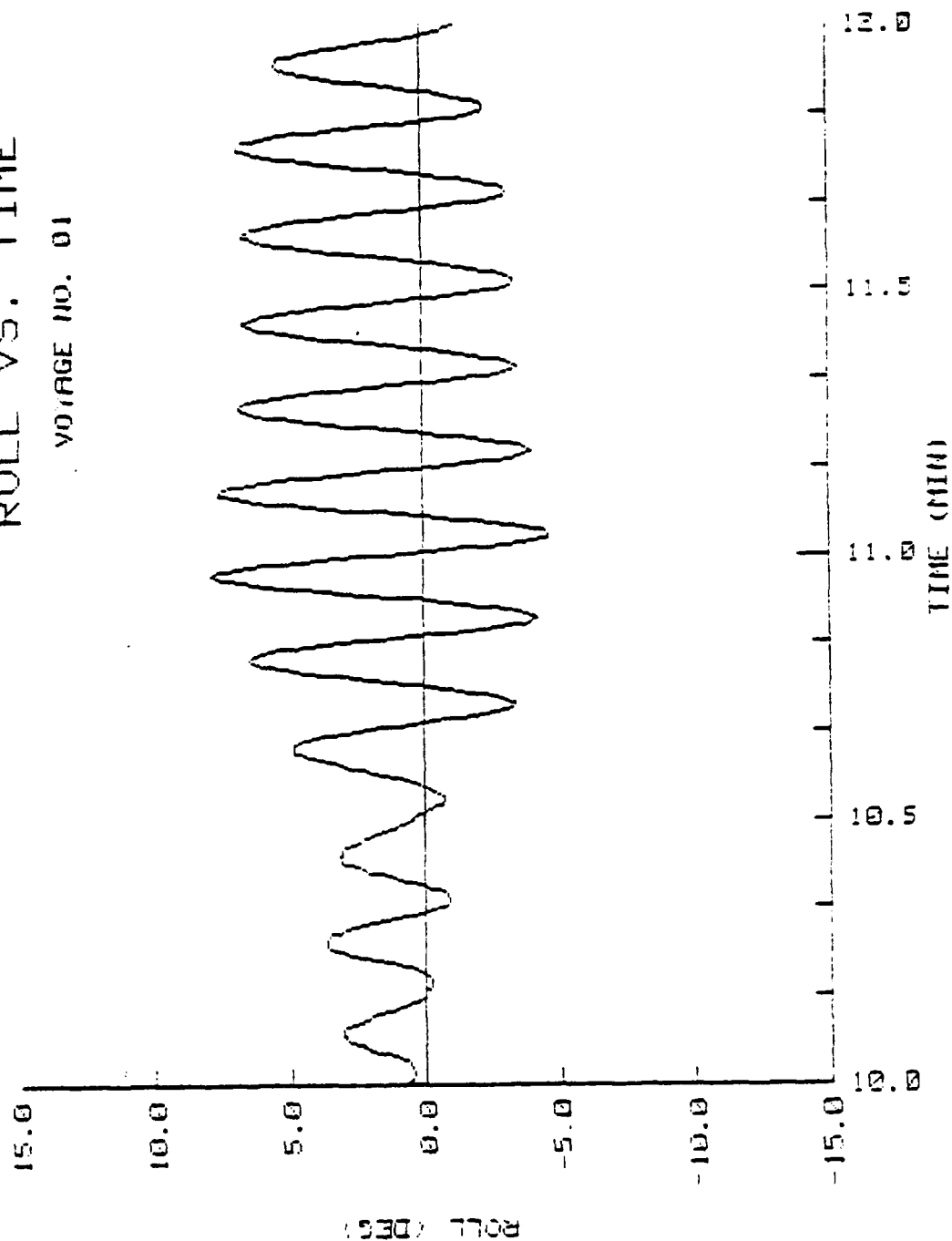


100 1000



# ROLL VS. TIME

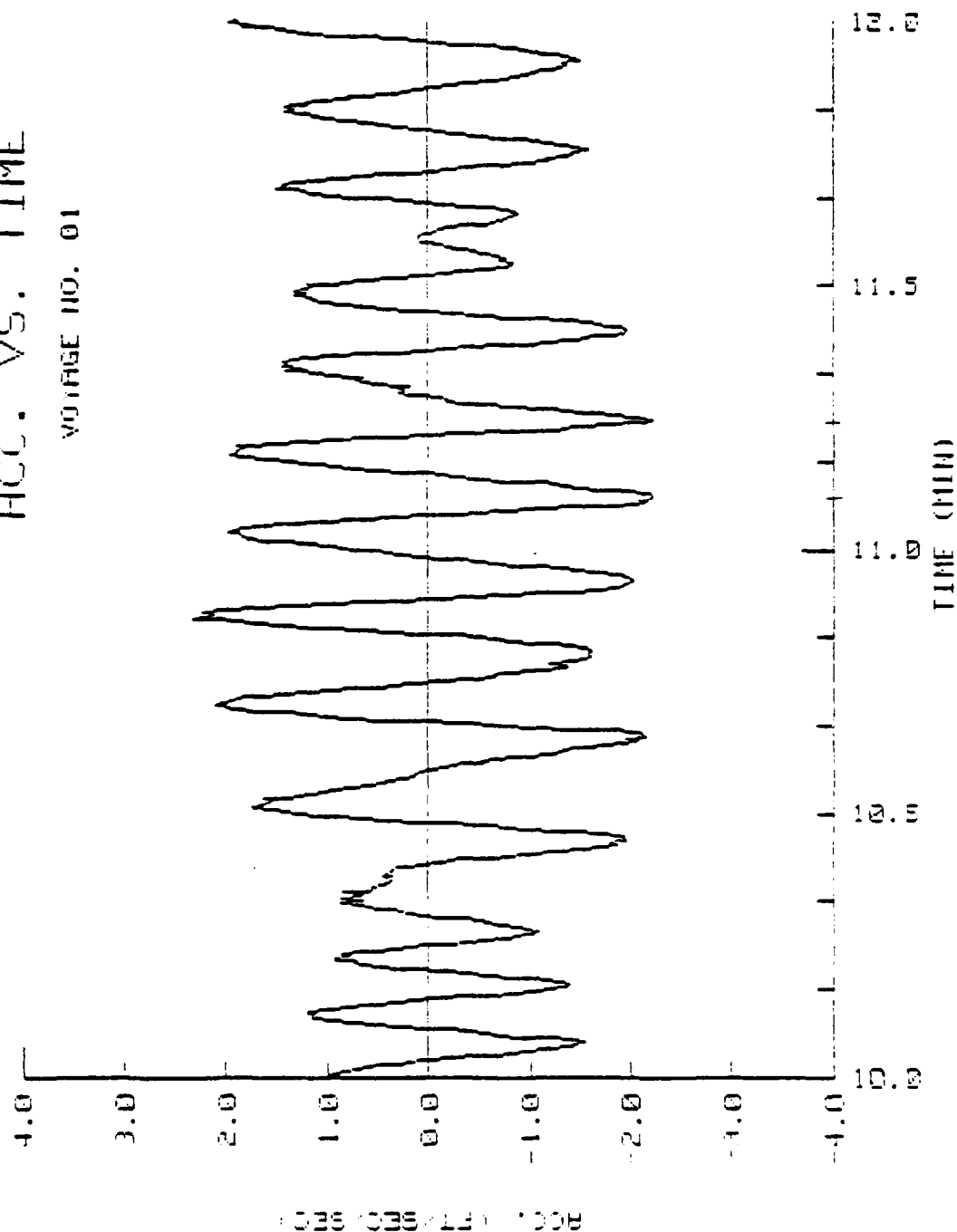
VOTAGE NO. 01





ACC. VS. TIME

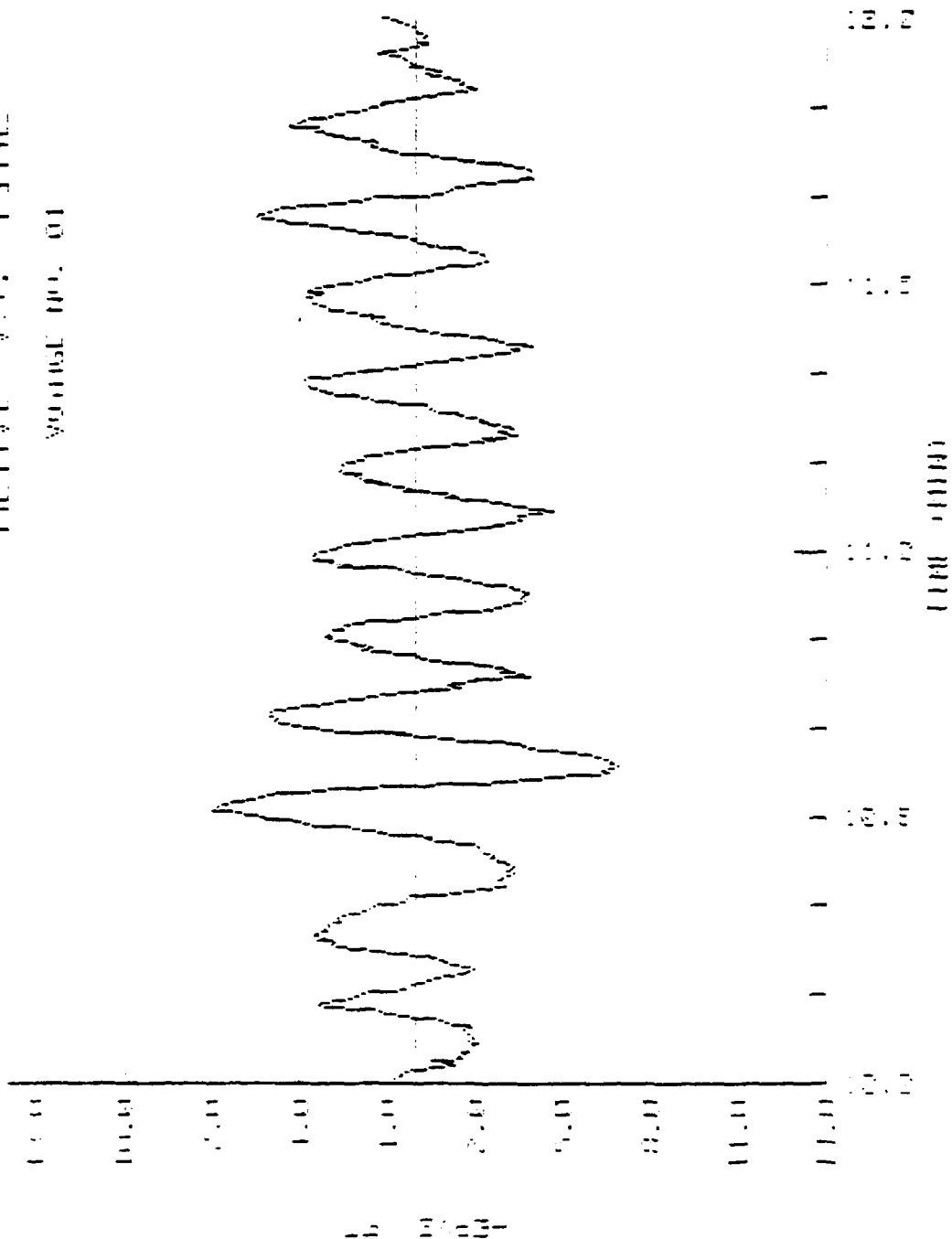
VOLUME NO. 01





RELATIVE VOLTAGE TIME

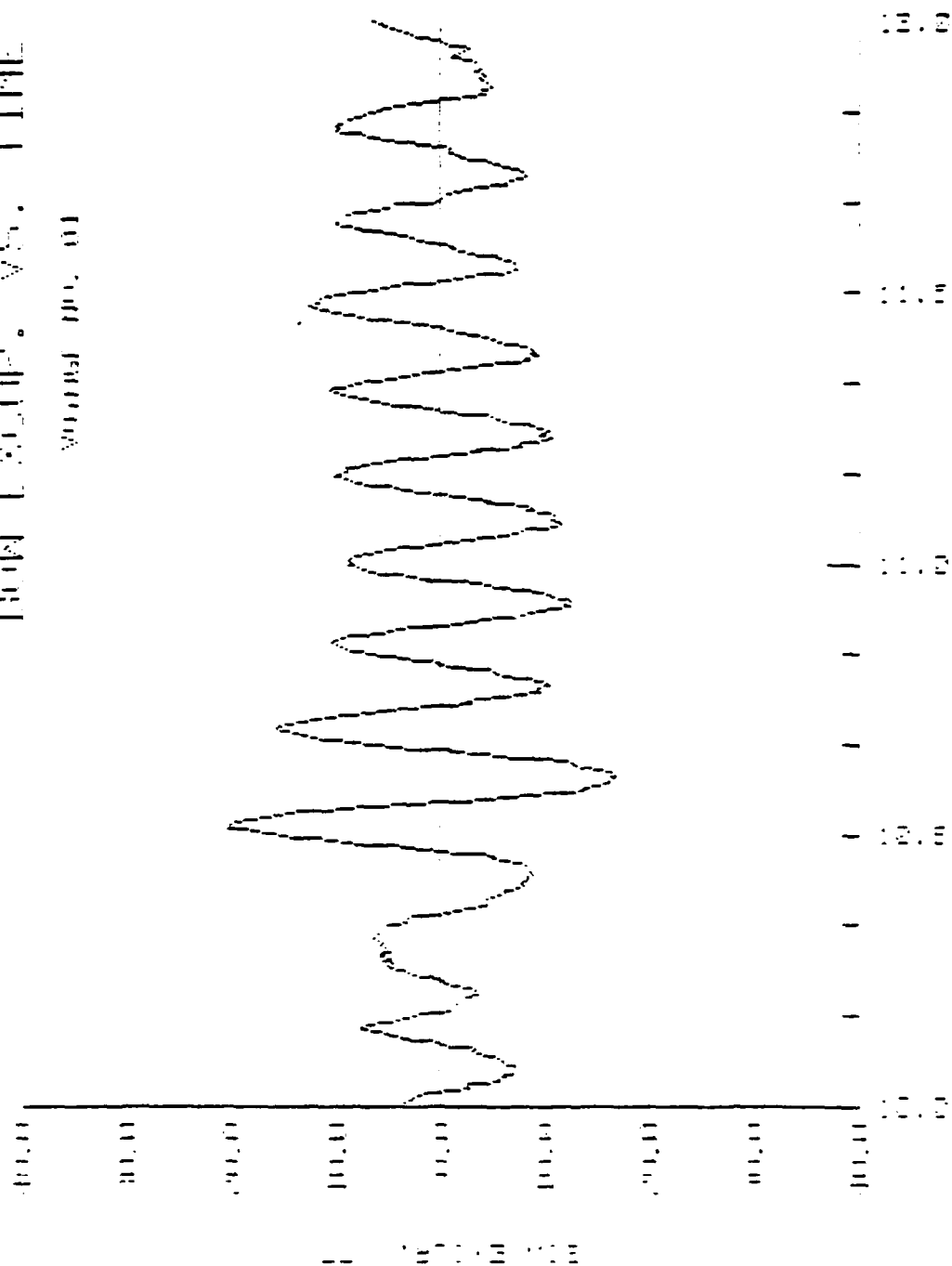
VOLTAGE 100.01





HOW GROUP. VS. TIME

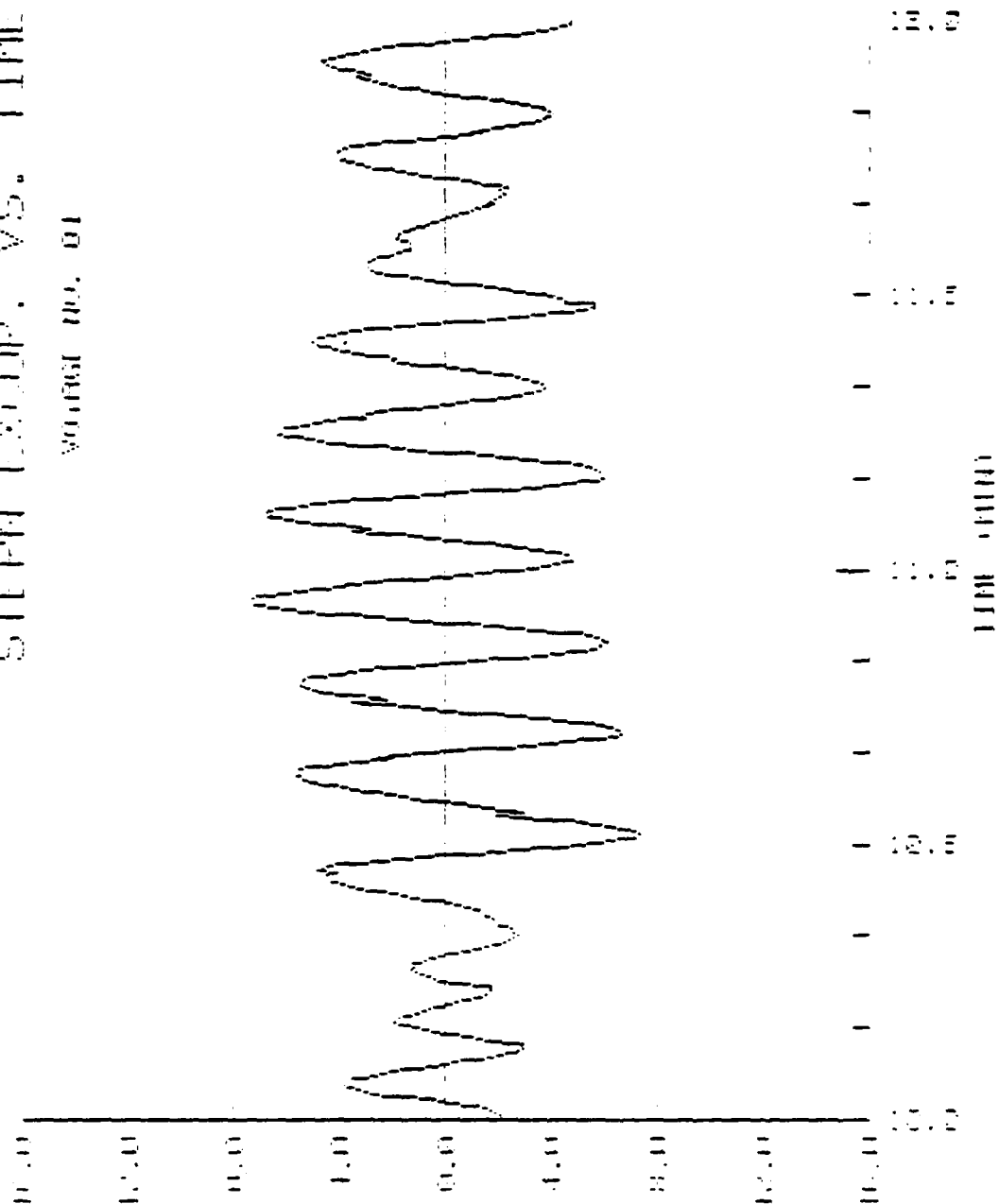
WAVE NO. 01





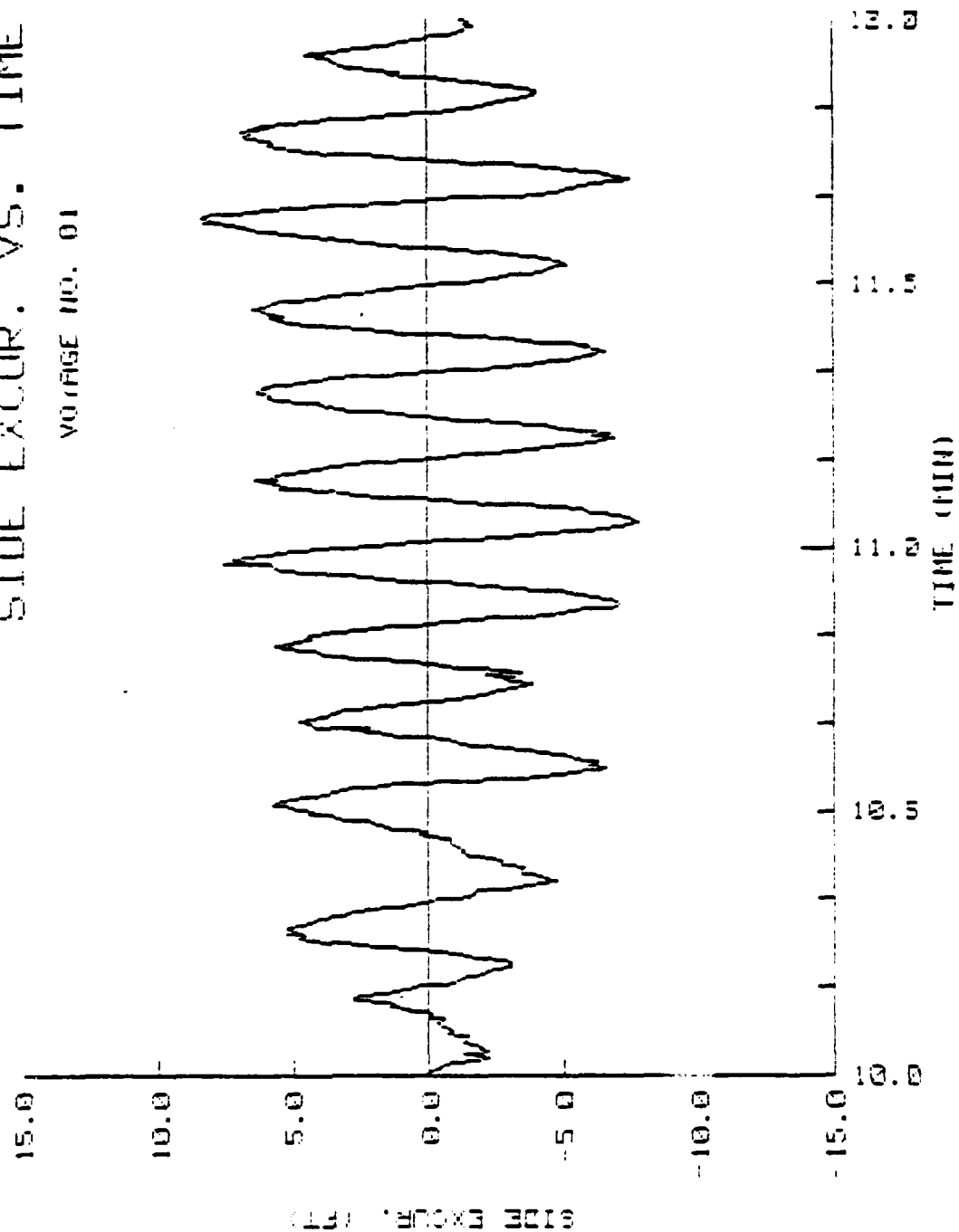
STEPH GROUP. VS. TIME

WATER NO. 01





SIDE EXCUR. VS. TIME  
VOYAGE NO. 01





# STATISTICAL SUMMARY

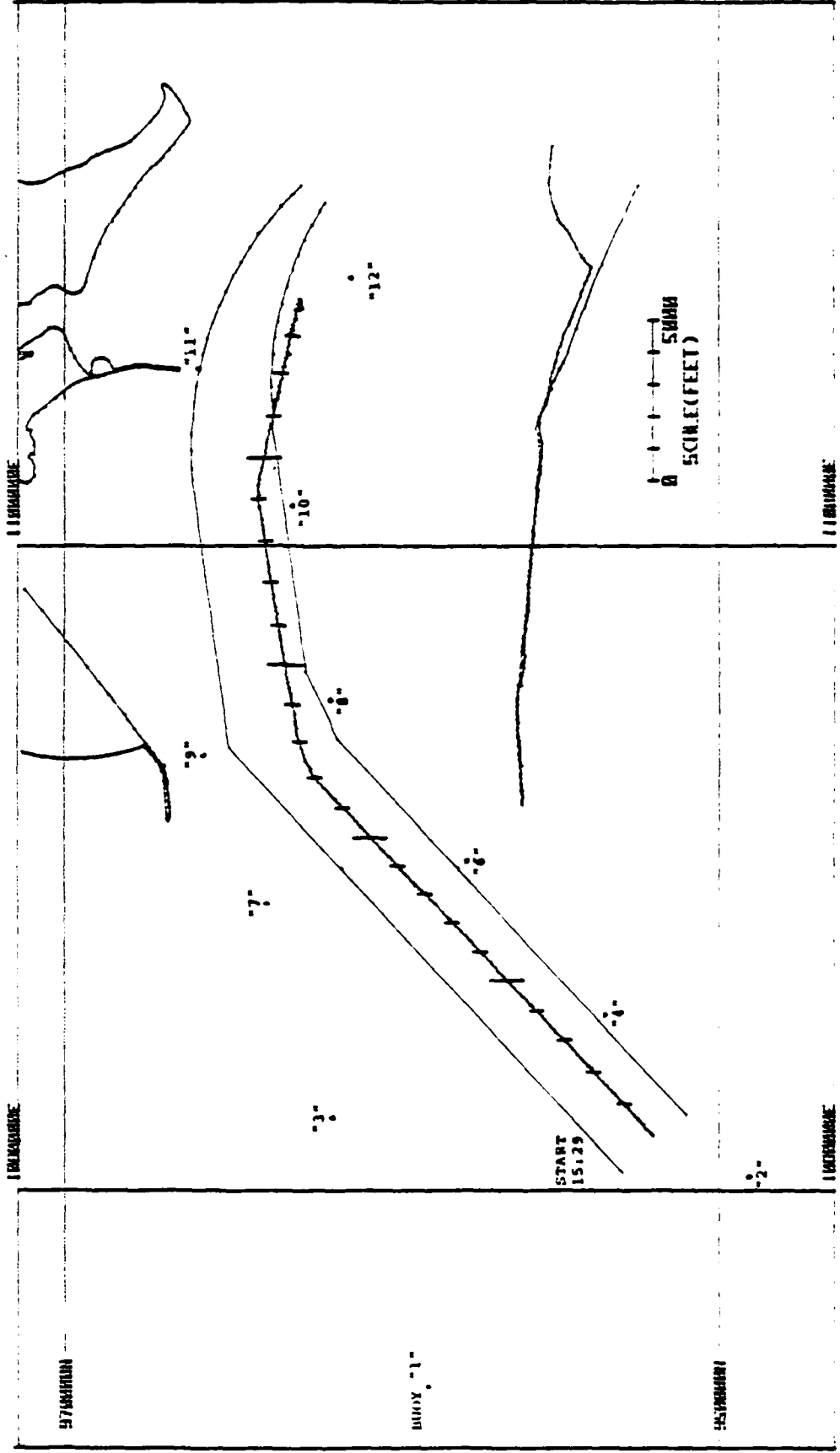
VOYAGE NO. 02

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.4	1.3	.6	.6
ROLL (DEG)	.2	2.9	1.1	1.3
ACC (FT/SEC/SEC)	-.0	1.1	.6	.6
HEAVE (FT)	.0	3.6	1.6	1.8
BOW EXCUR. (FT)	.0	10.4	4.2	4.7
STEER EXCUR. (FT)	.0	3.8	1.5	1.6
SIDE EXCUR (FT)	.0	4.2	1.8	2.0



# VOYAGE NO. 02 SHIP TRACK

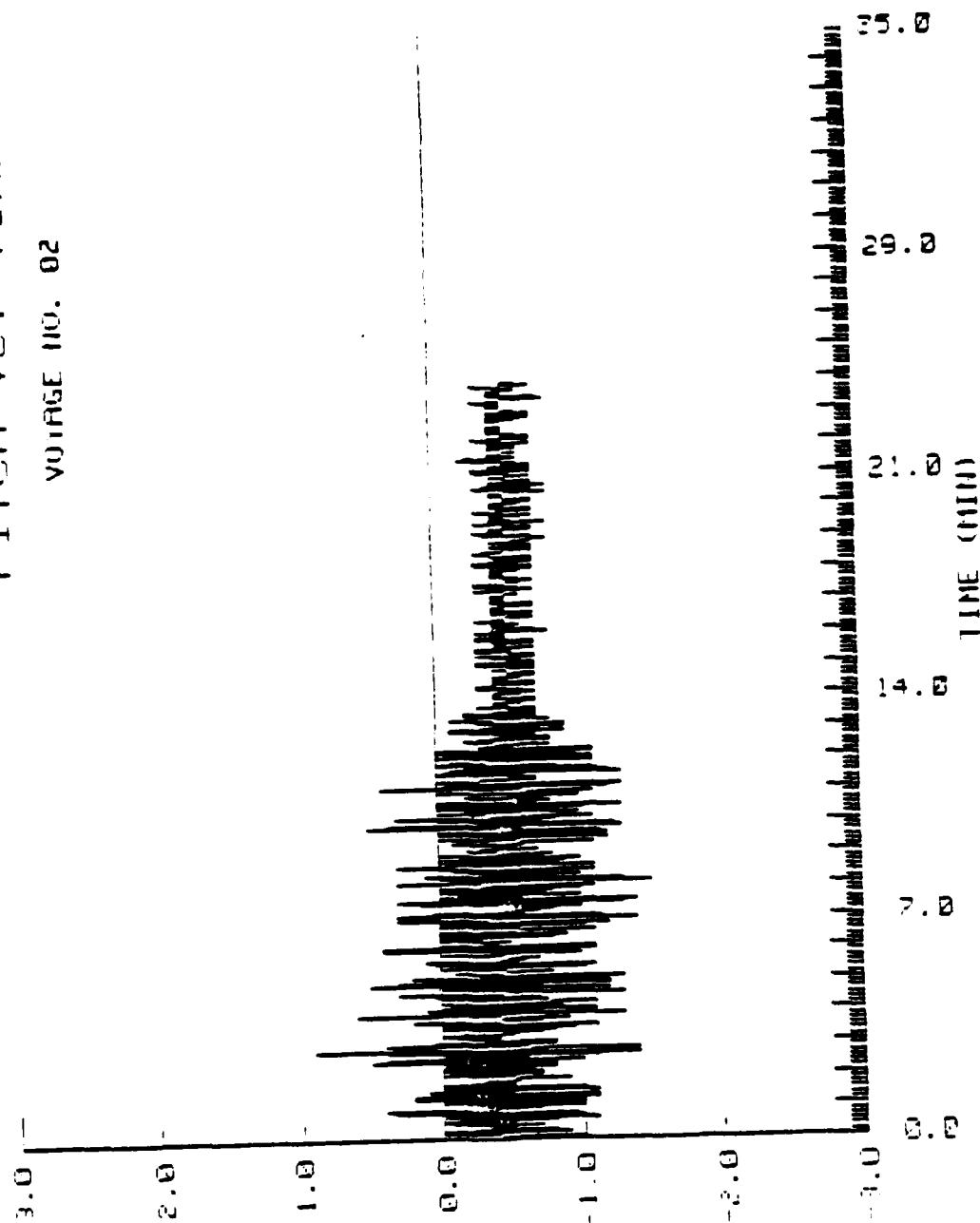
SCALE: 1 INCH = 5 MILES





# PITCH VS. TIME

VOTAGE NO. 02

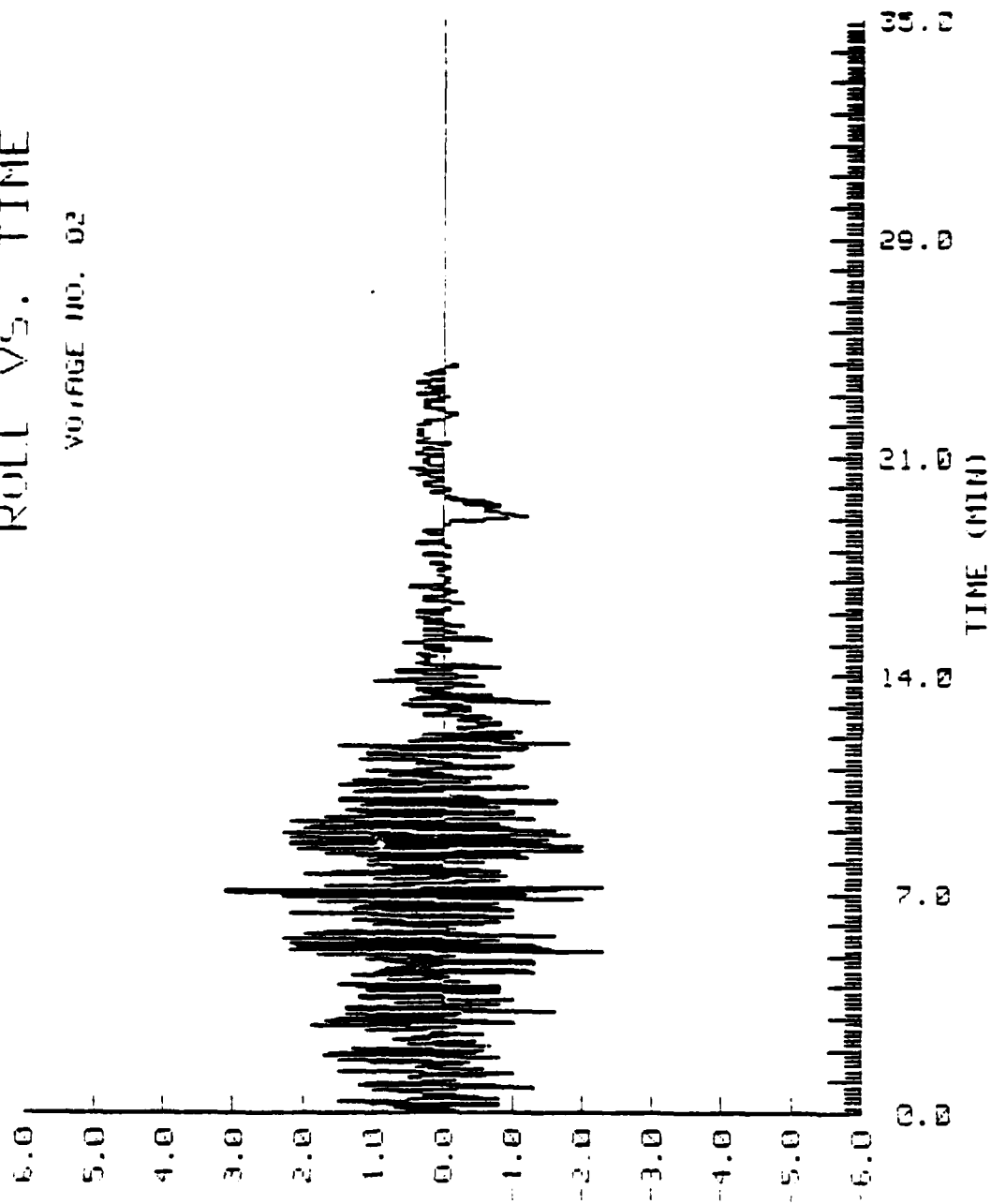


930 - 5000



# ROLL VS. TIME

VOLUME NO. 02

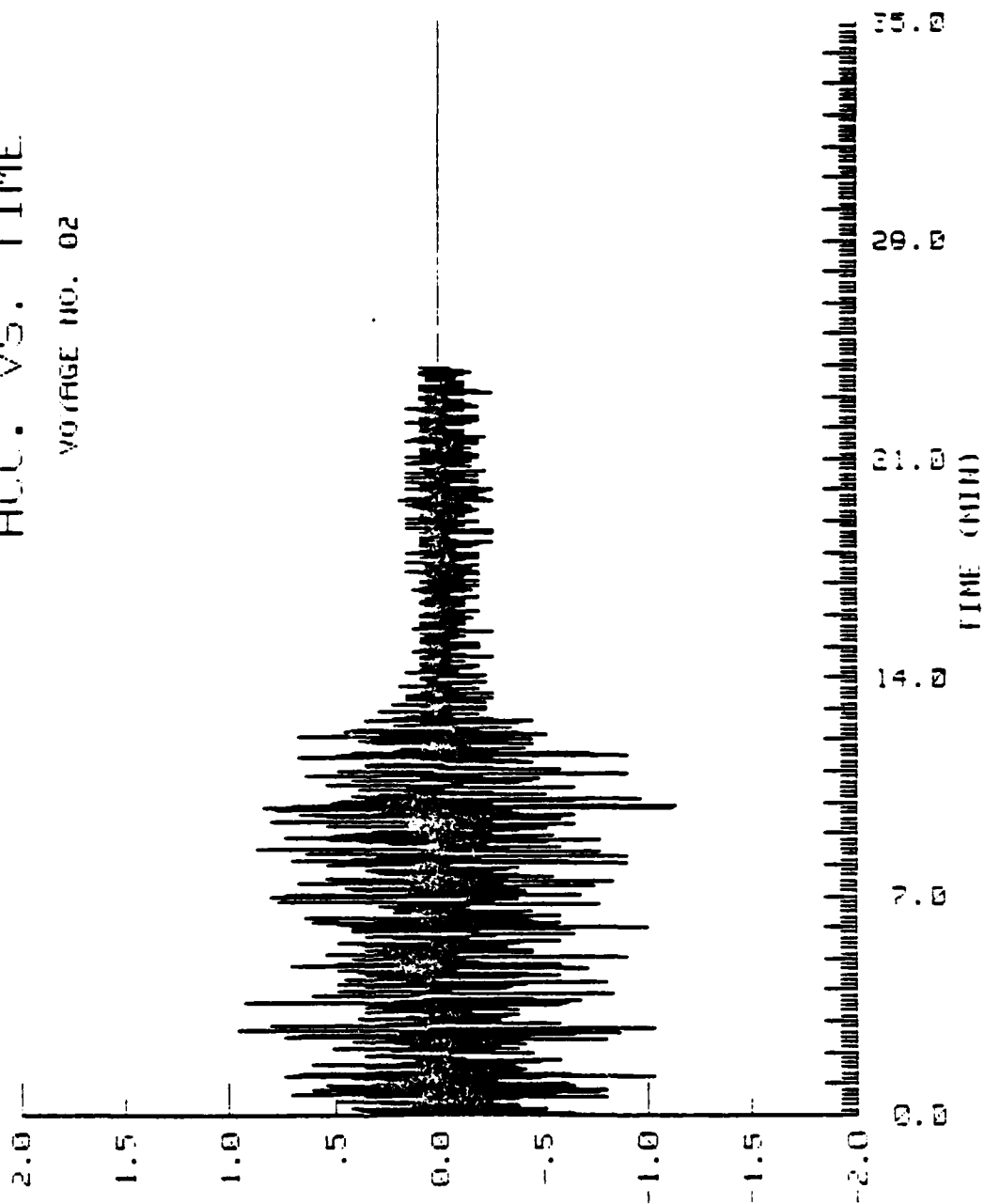


1951-1952



ACC. V5. TIME

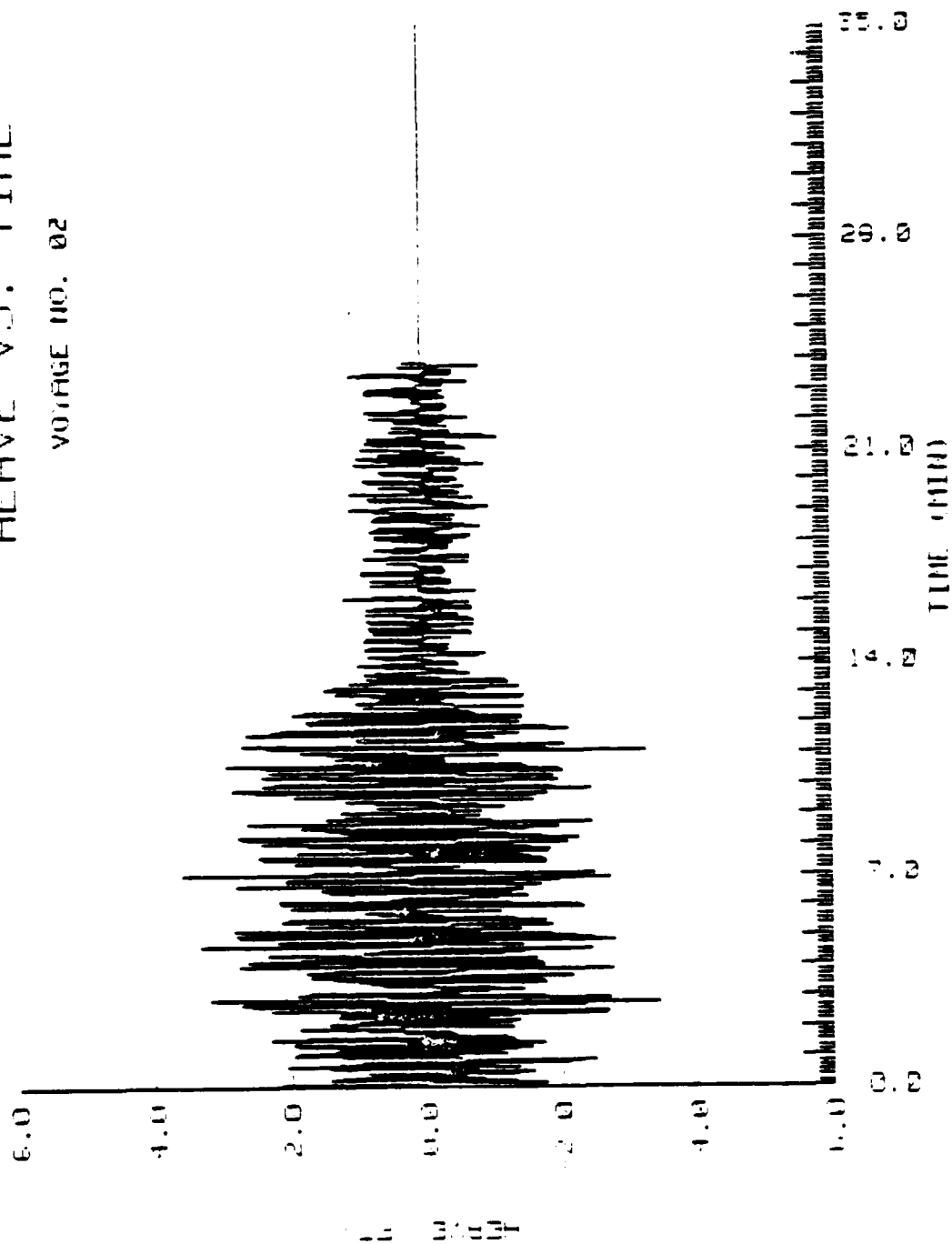
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# HEAVE VS. TIME

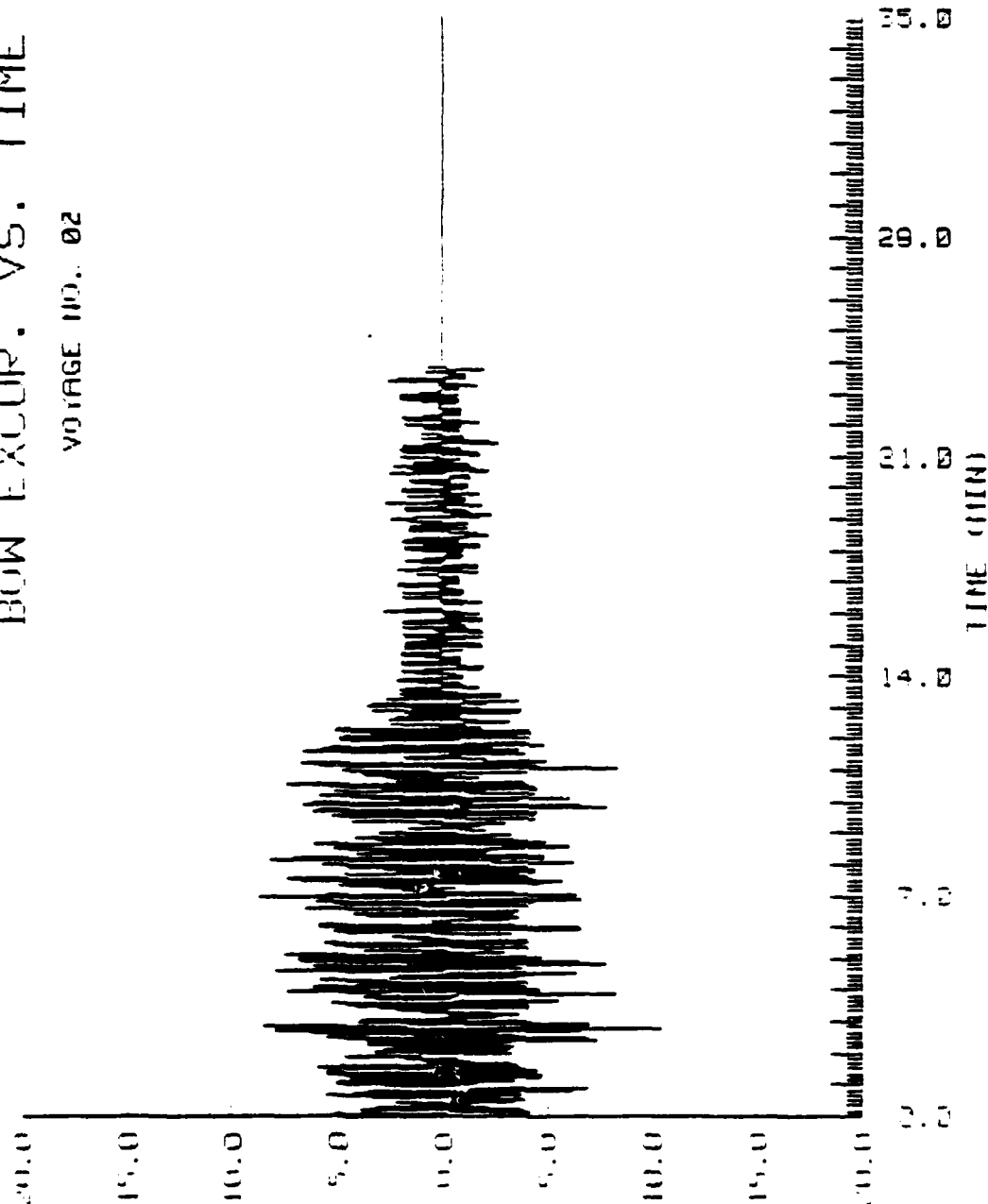
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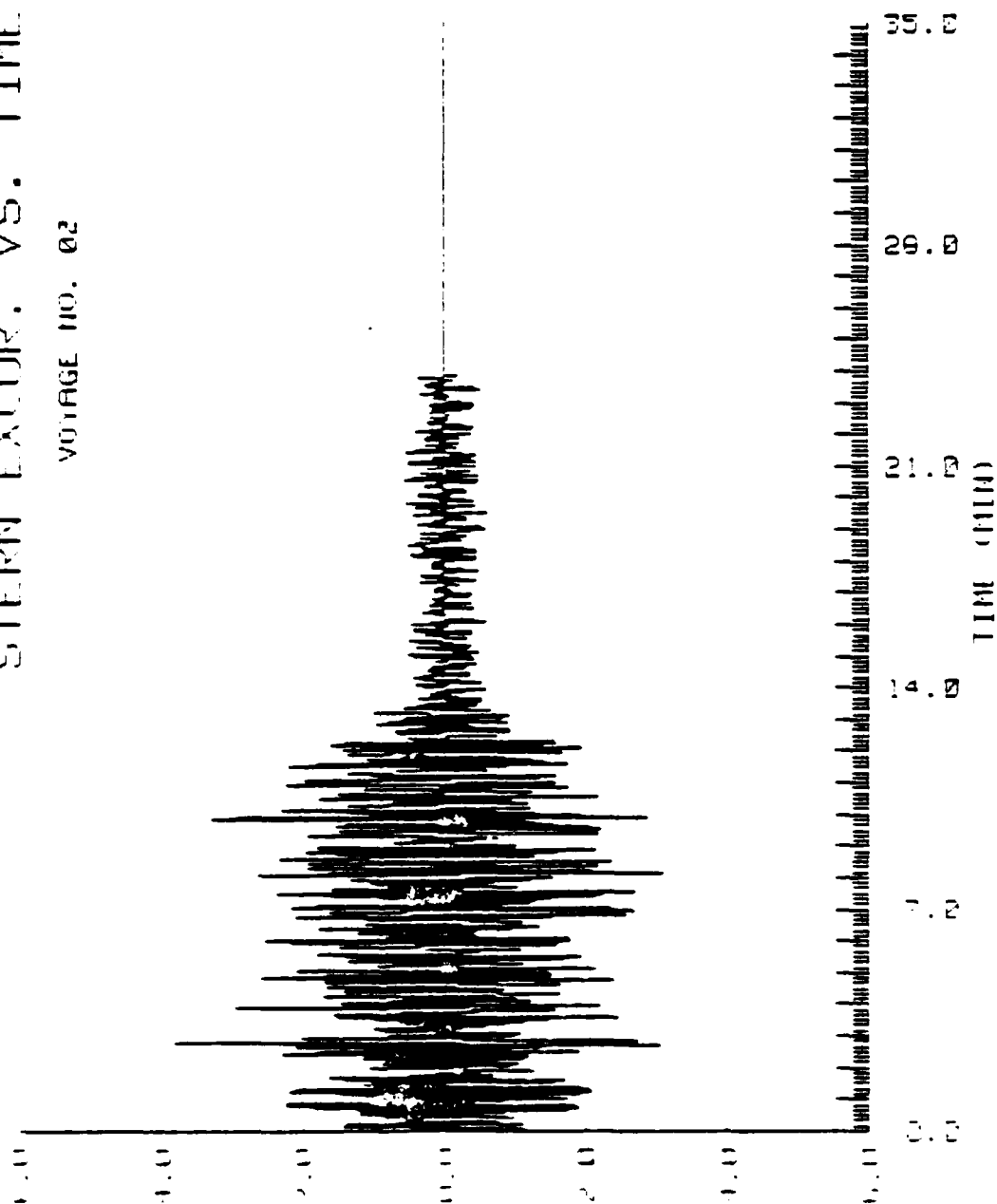
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1 1470-3 033



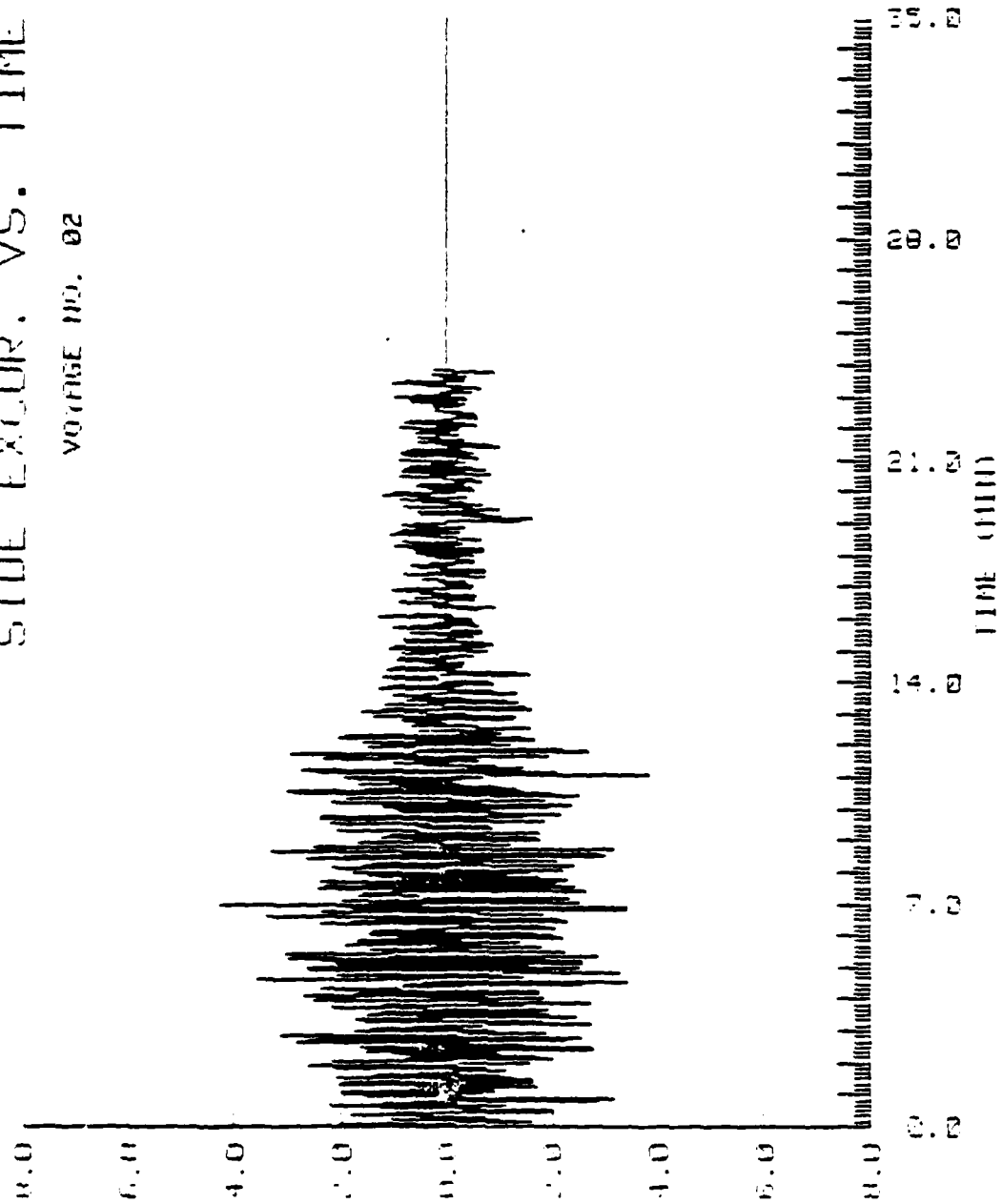
**VOLUME NO. 02**





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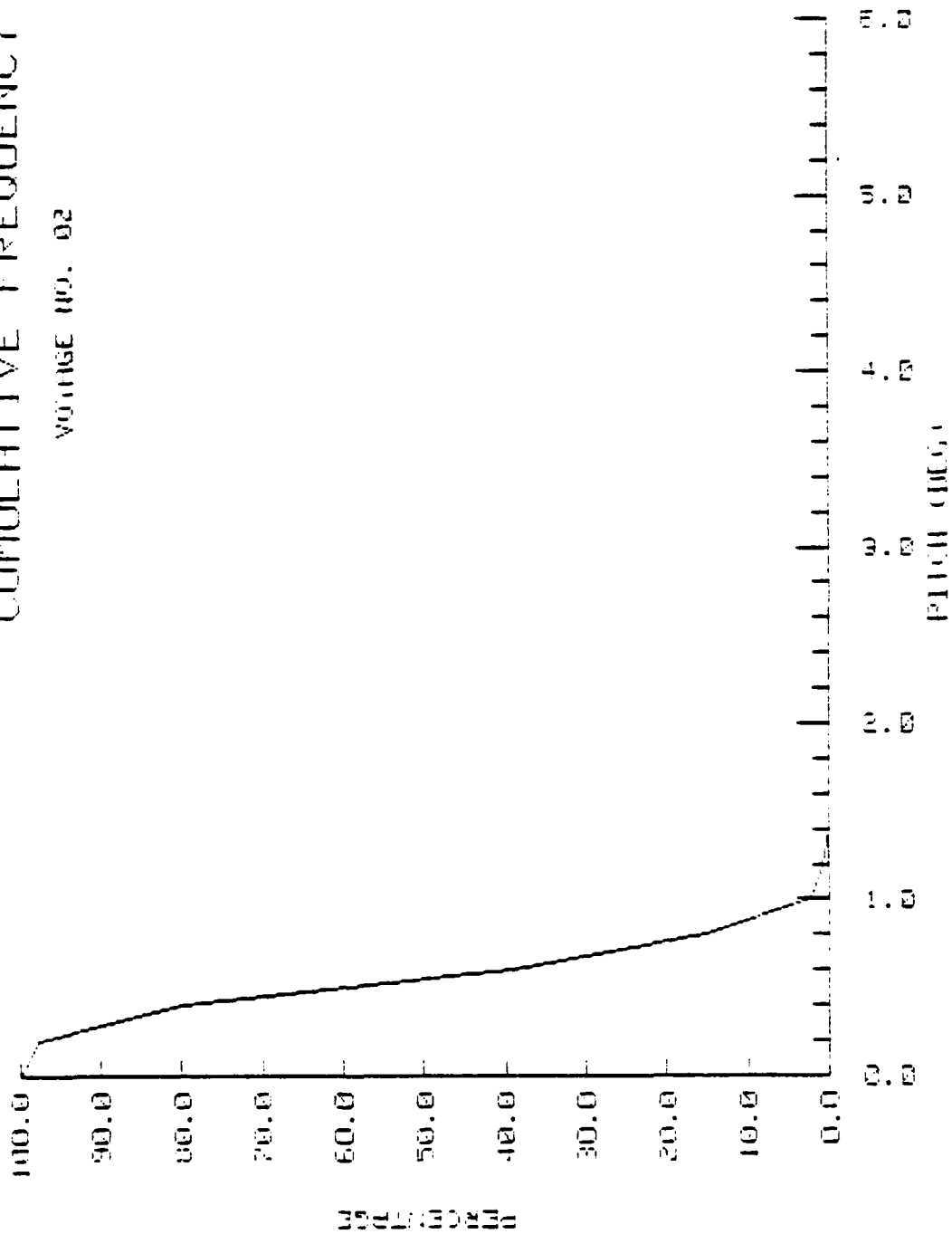
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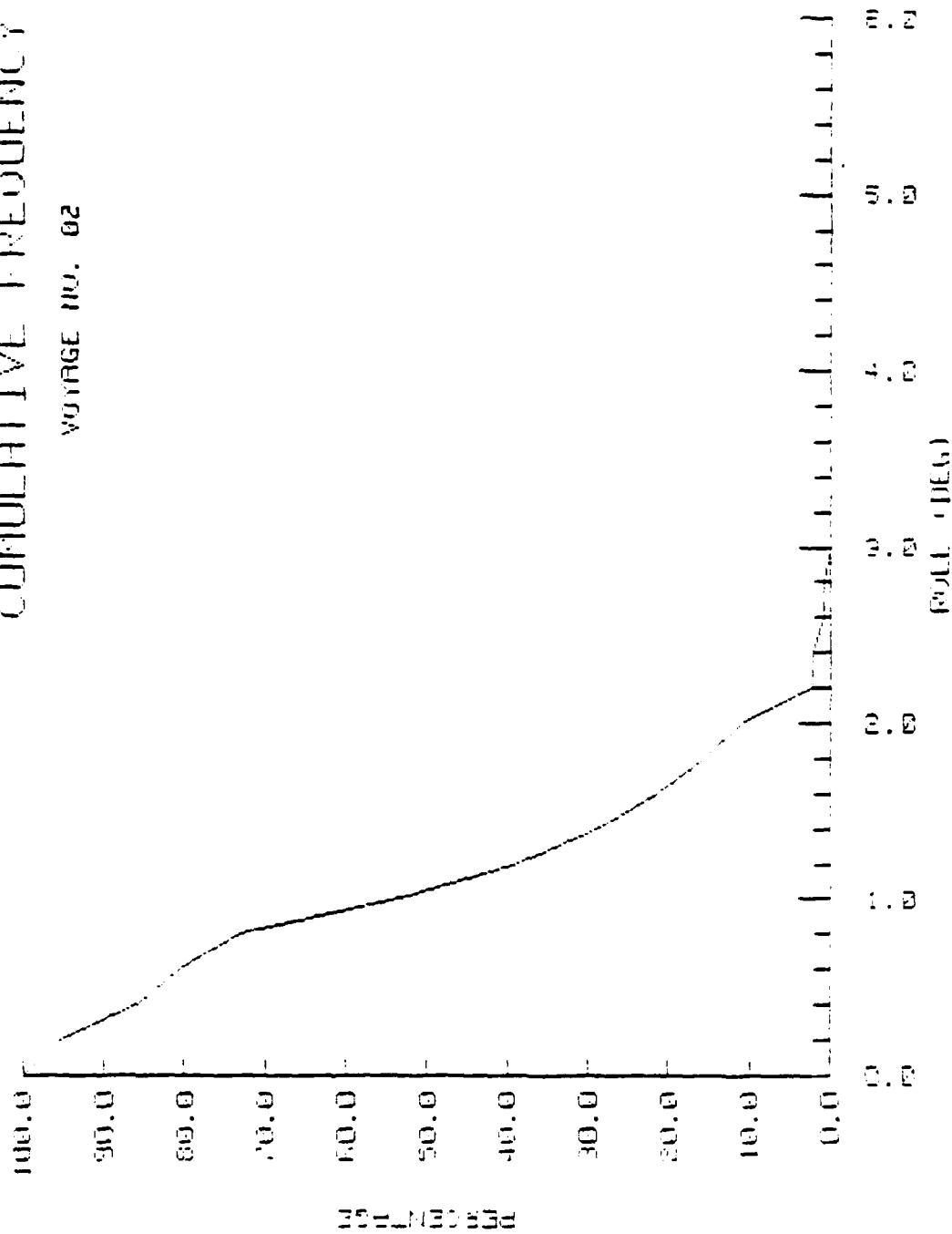
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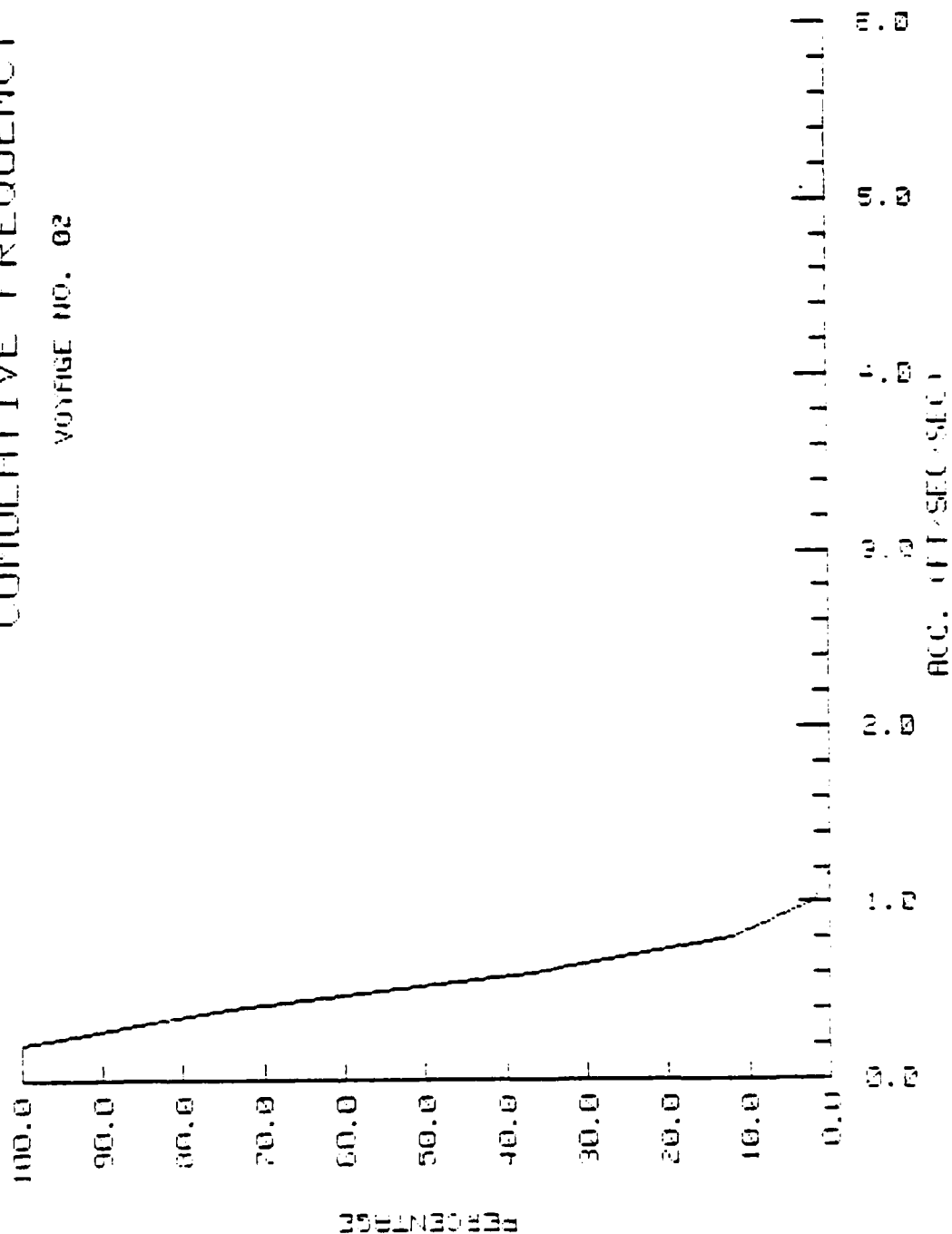
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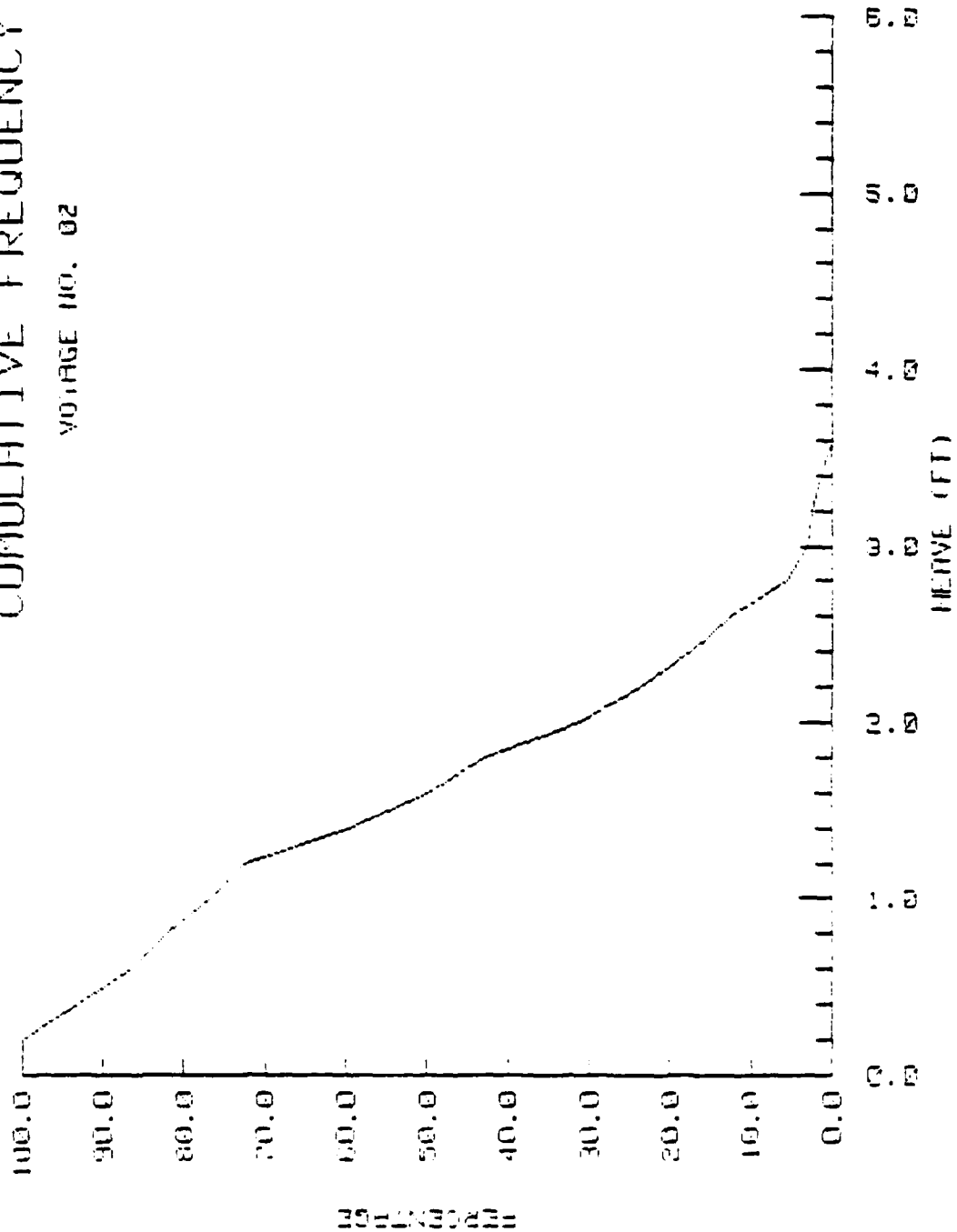
VOYAGE NO. 02





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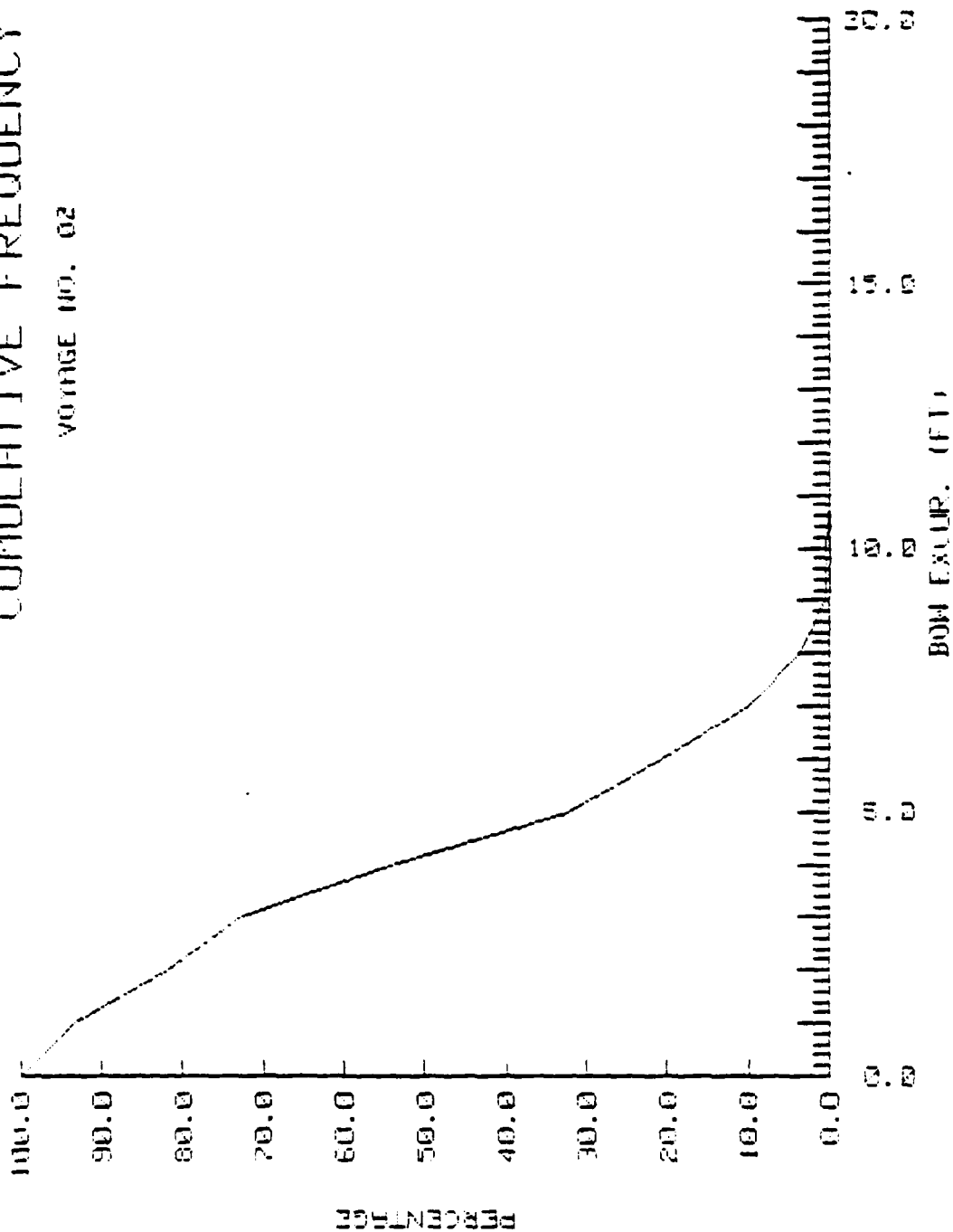
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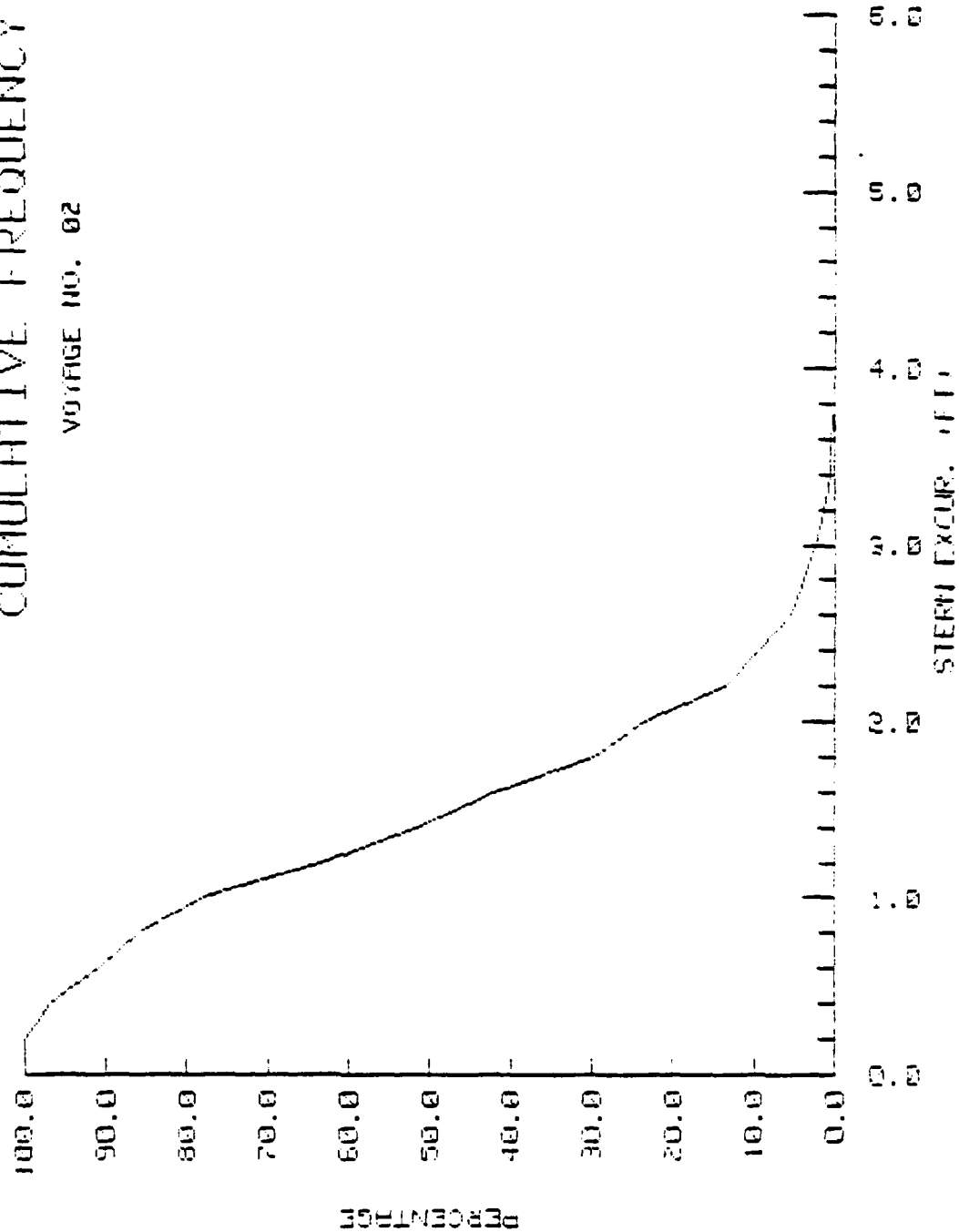
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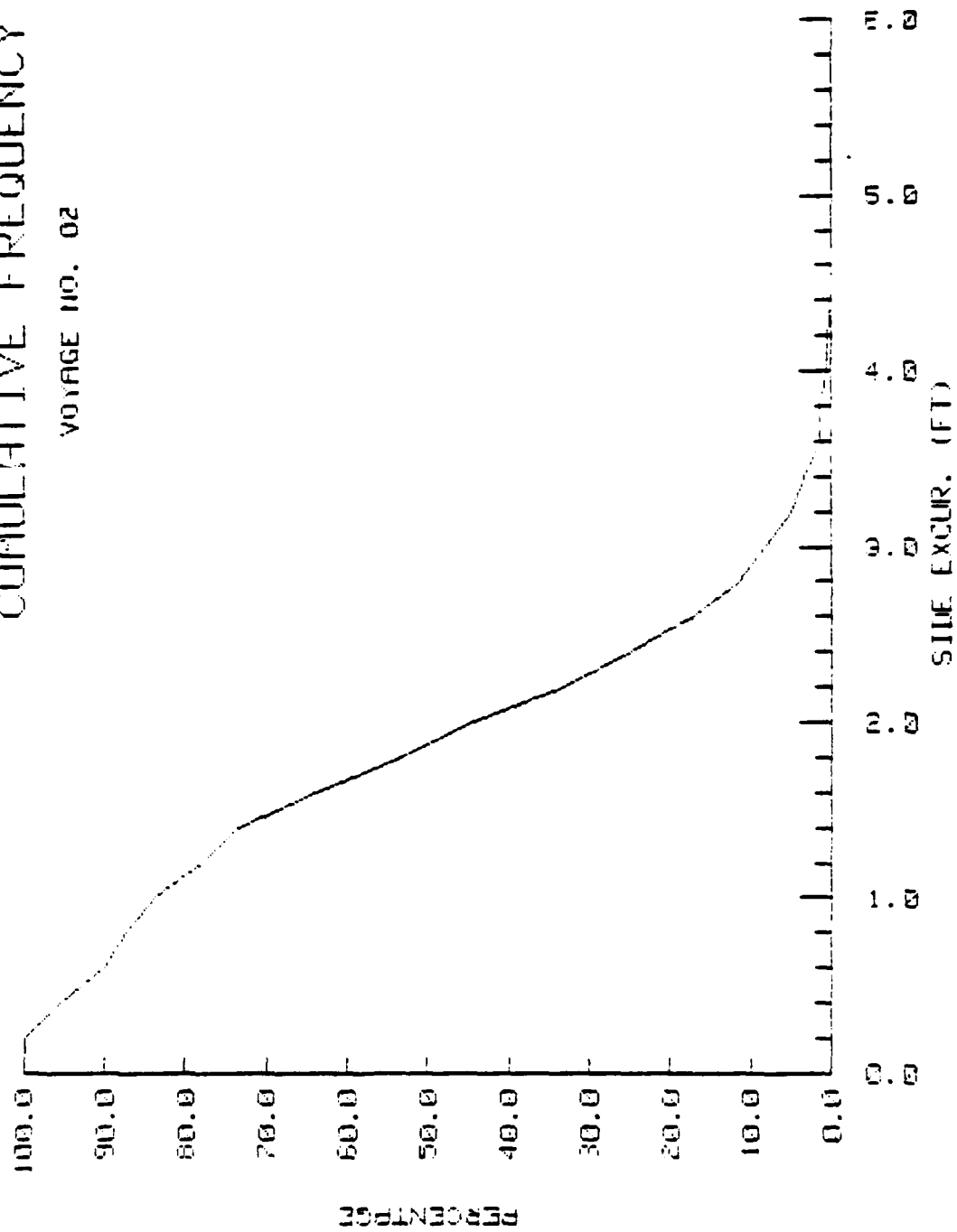
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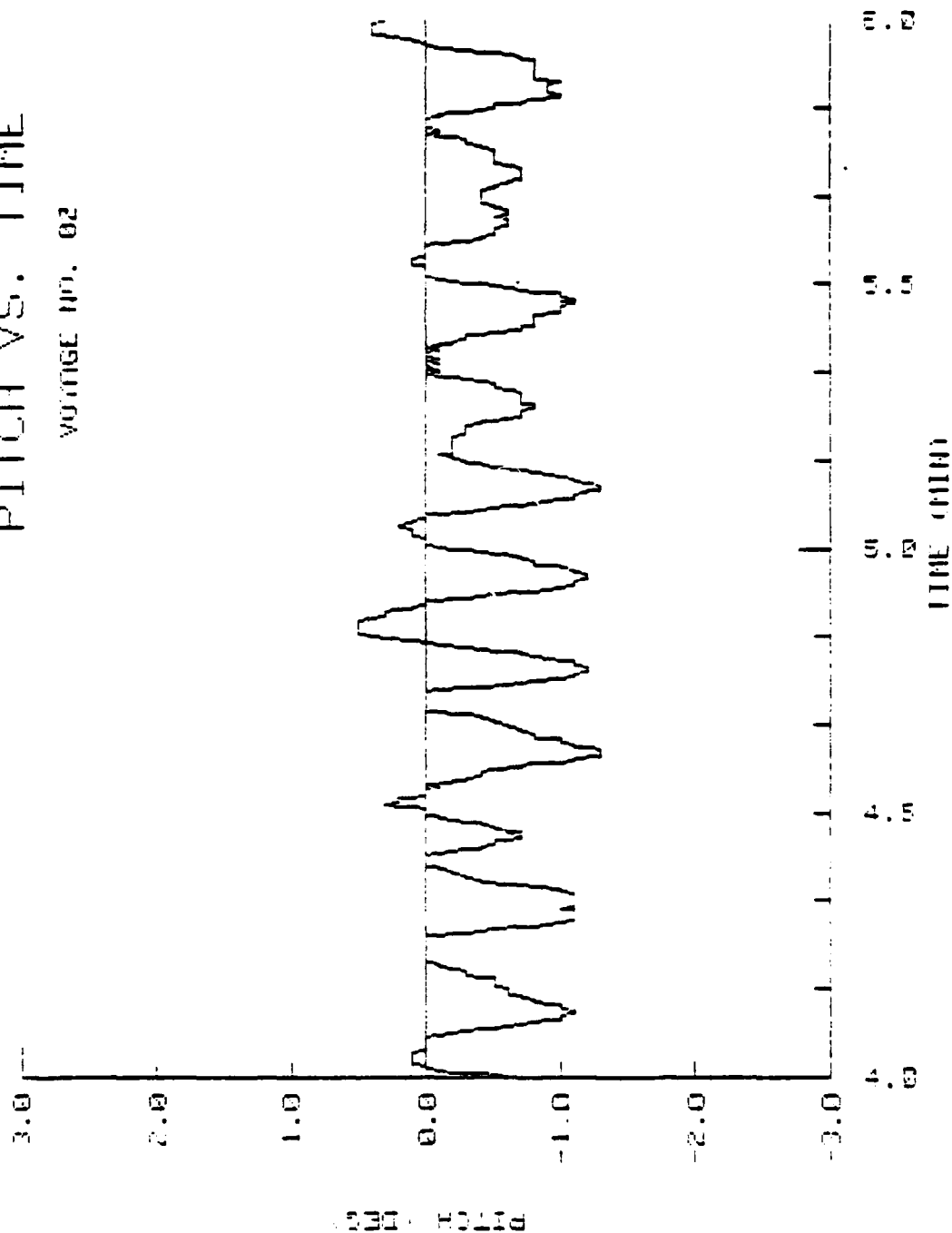
VOYAGE NO. 02





# PITCH VS. TIME

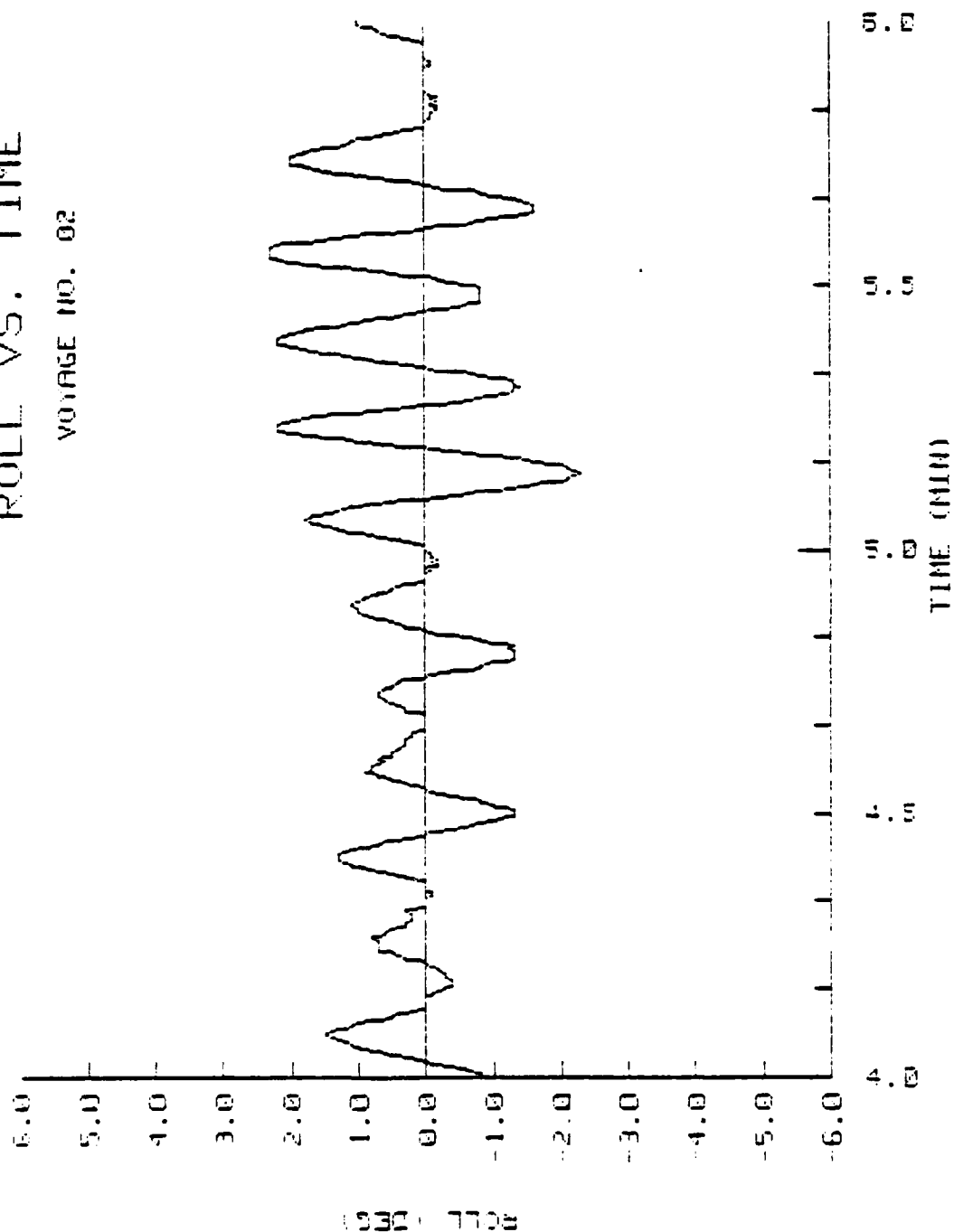
VOICE NO. 02





# ROLL VS. TIME

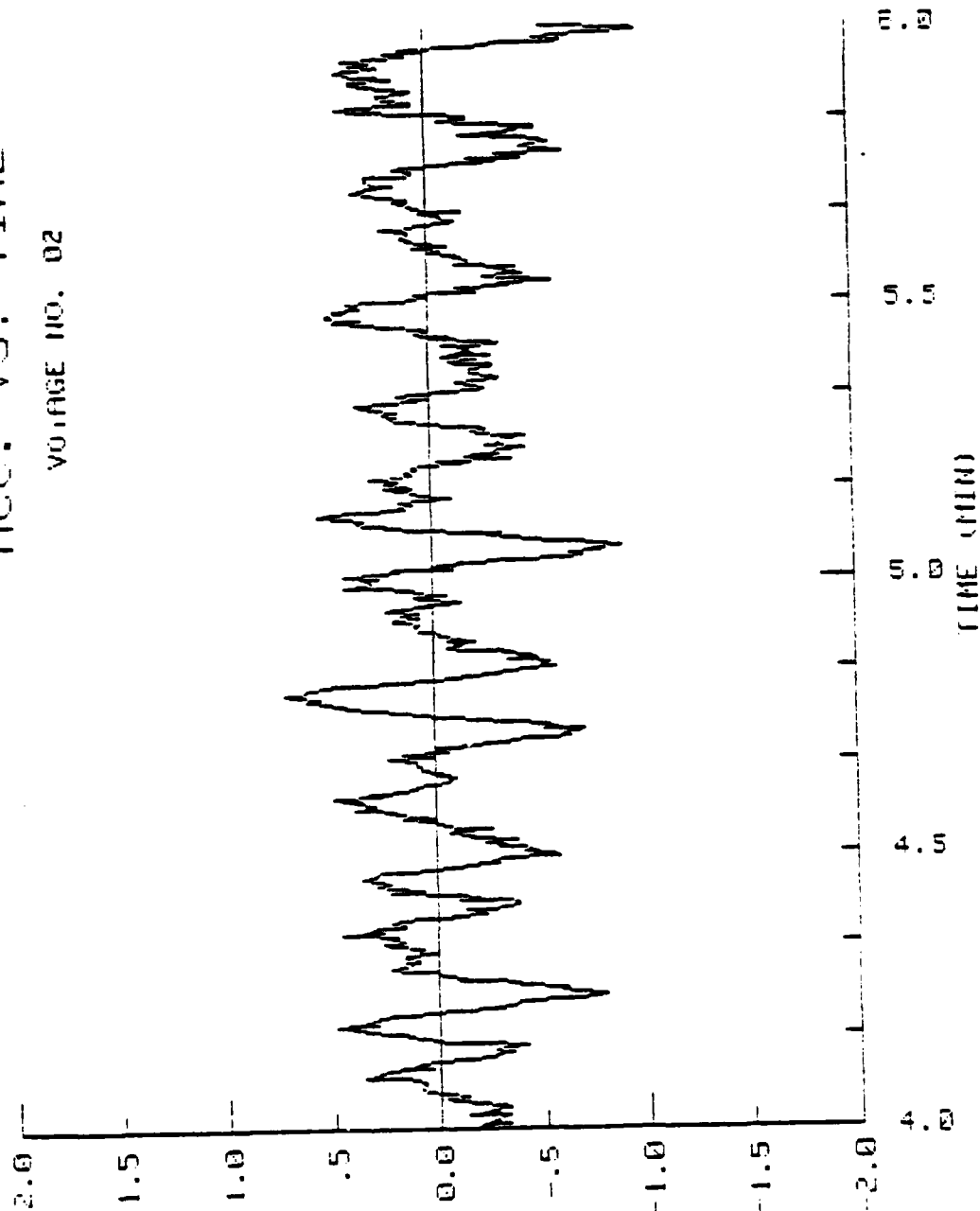
VOLTAJE NO. 02





# ACC. VS. TIME

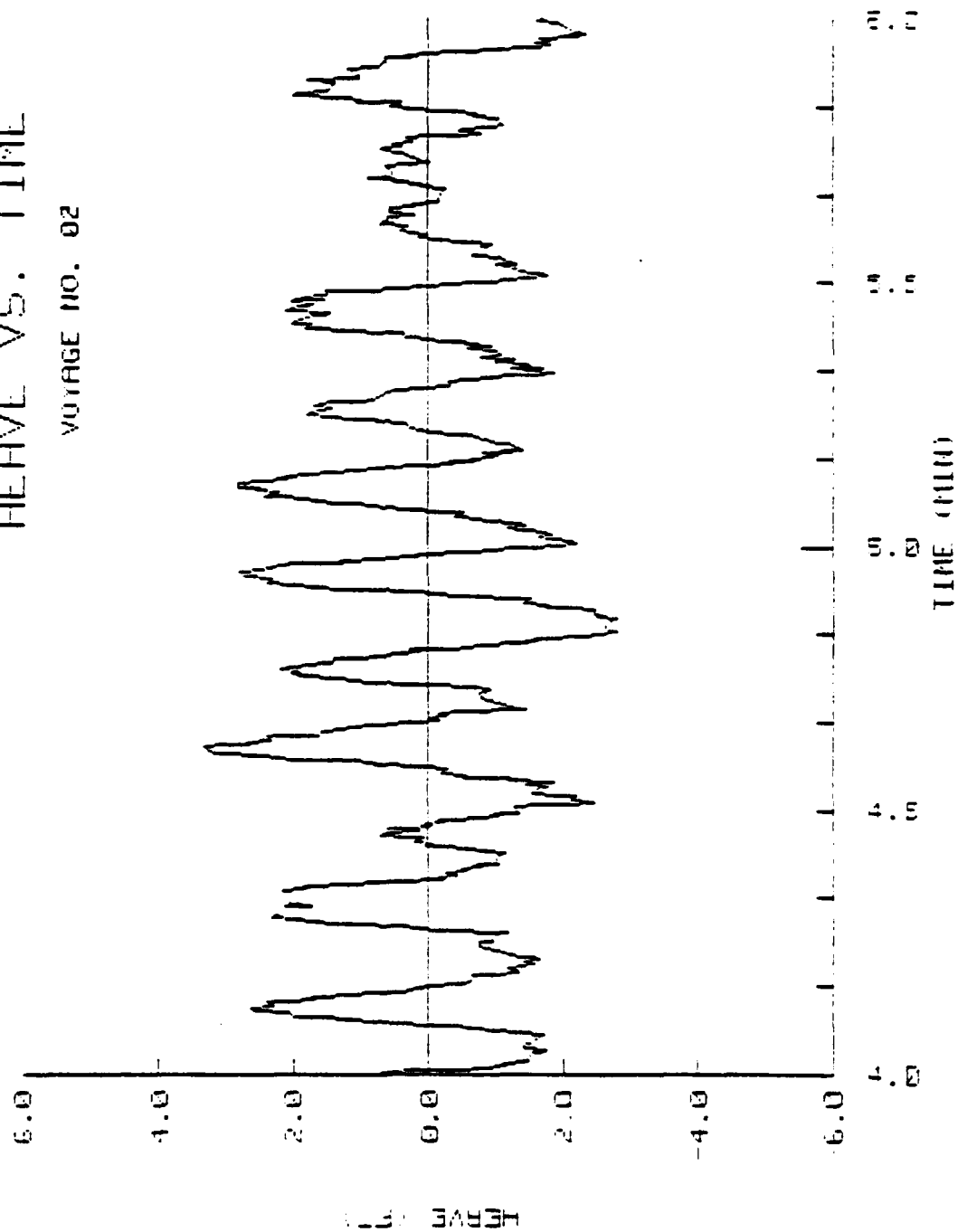
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# HEAVE VS. TIME

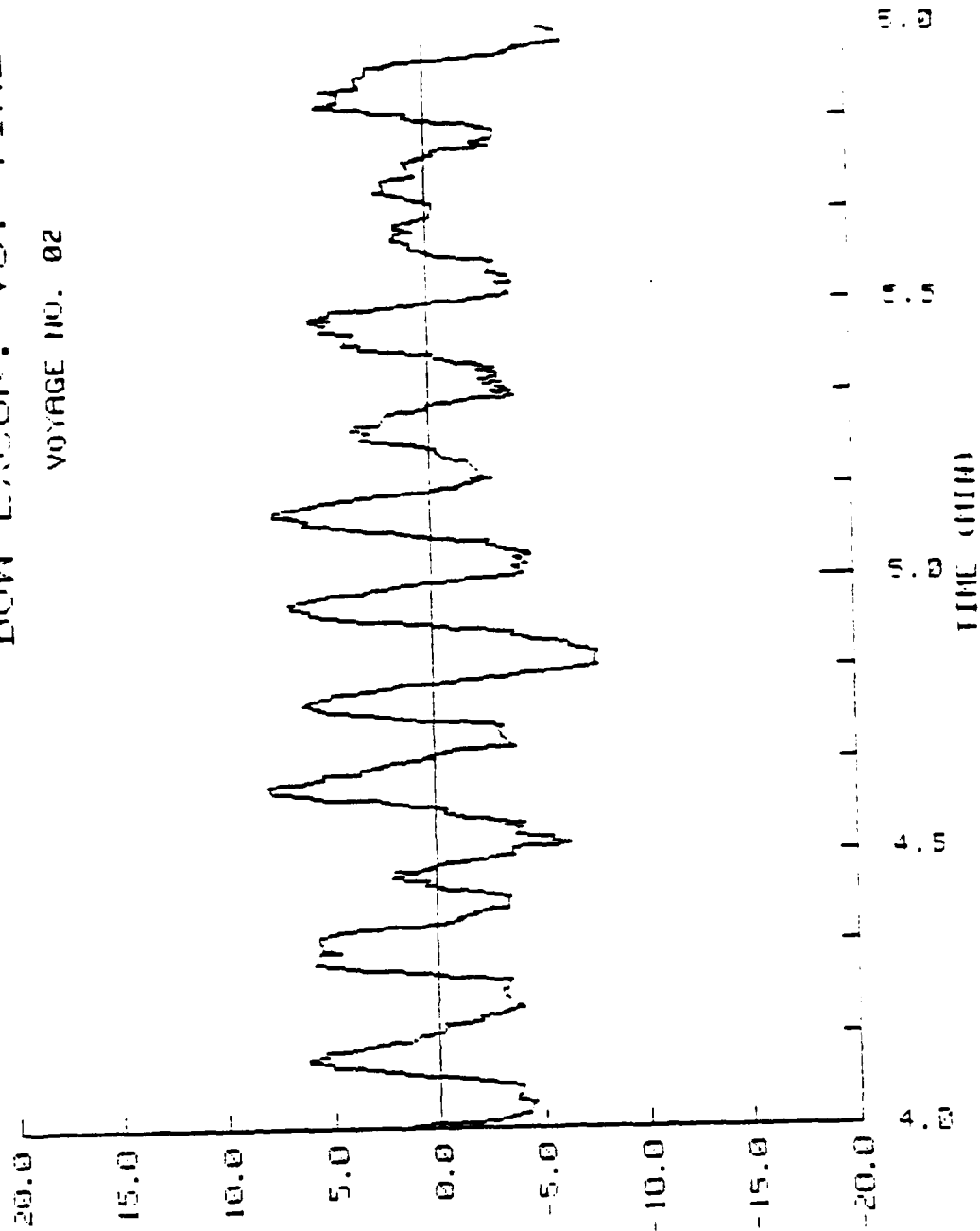
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# BOW EXCUR. VS. TIME

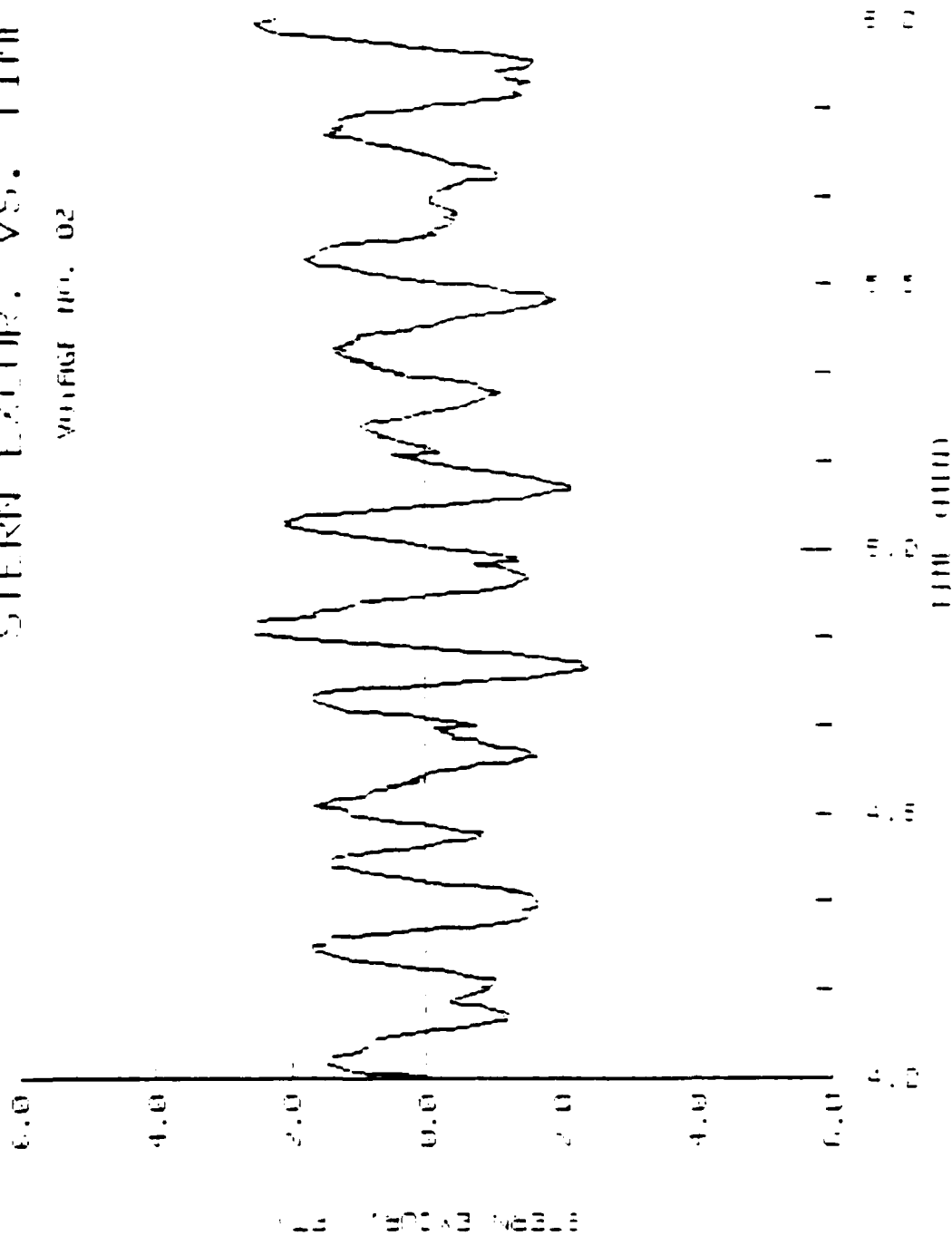
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STERN EQUIL. VS. TIME

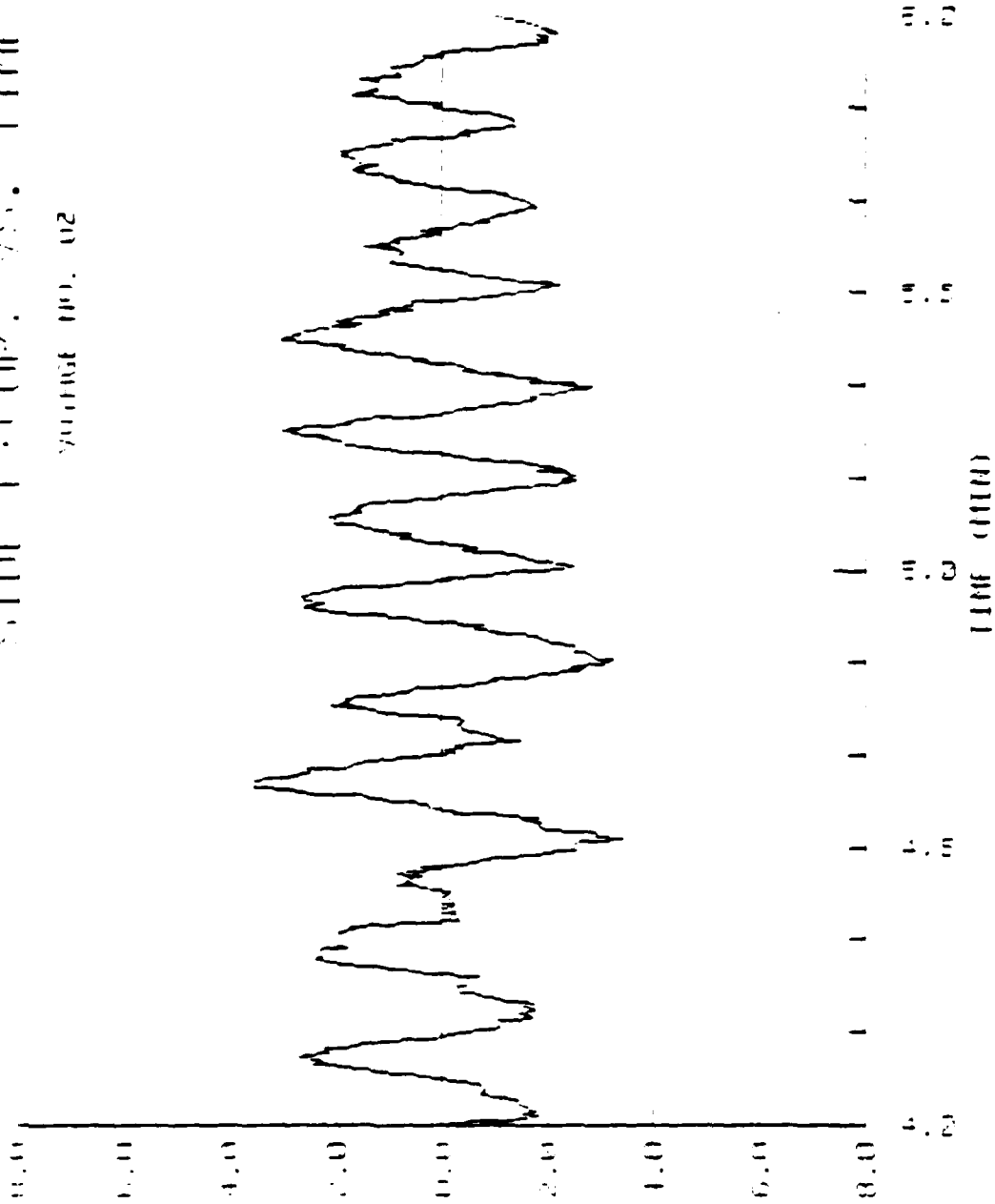
Y01F01 100. 02





5.1111 1.0000 0.0000 1.1111

0.0000 0.0000 0.0000





# STATISTICAL SUMMARY

VOYAGE NO. 03

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.0	.7	.3	.4
ROLL (DEG)	.8	1.4	.6	.7
HEAVE (FT. SEC. SEC.)	.0	1.7	.7	.8
HEAVE (FT.)	.0	2.8	1.1	1.2
BOW EXCUR. (FT.)	.0	6.3	2.6	2.9
STEER EXCUR. (FT.)	.0	2.1	.9	.9
SIDE EXCUR (FT.)	.0	2.5	1.0	1.2



# PUBLISHED WEEKLY Vol. 10, No. 10

100  
 200  
 300  
 400  
 500  
 600  
 700  
 800  
 900  
 1000



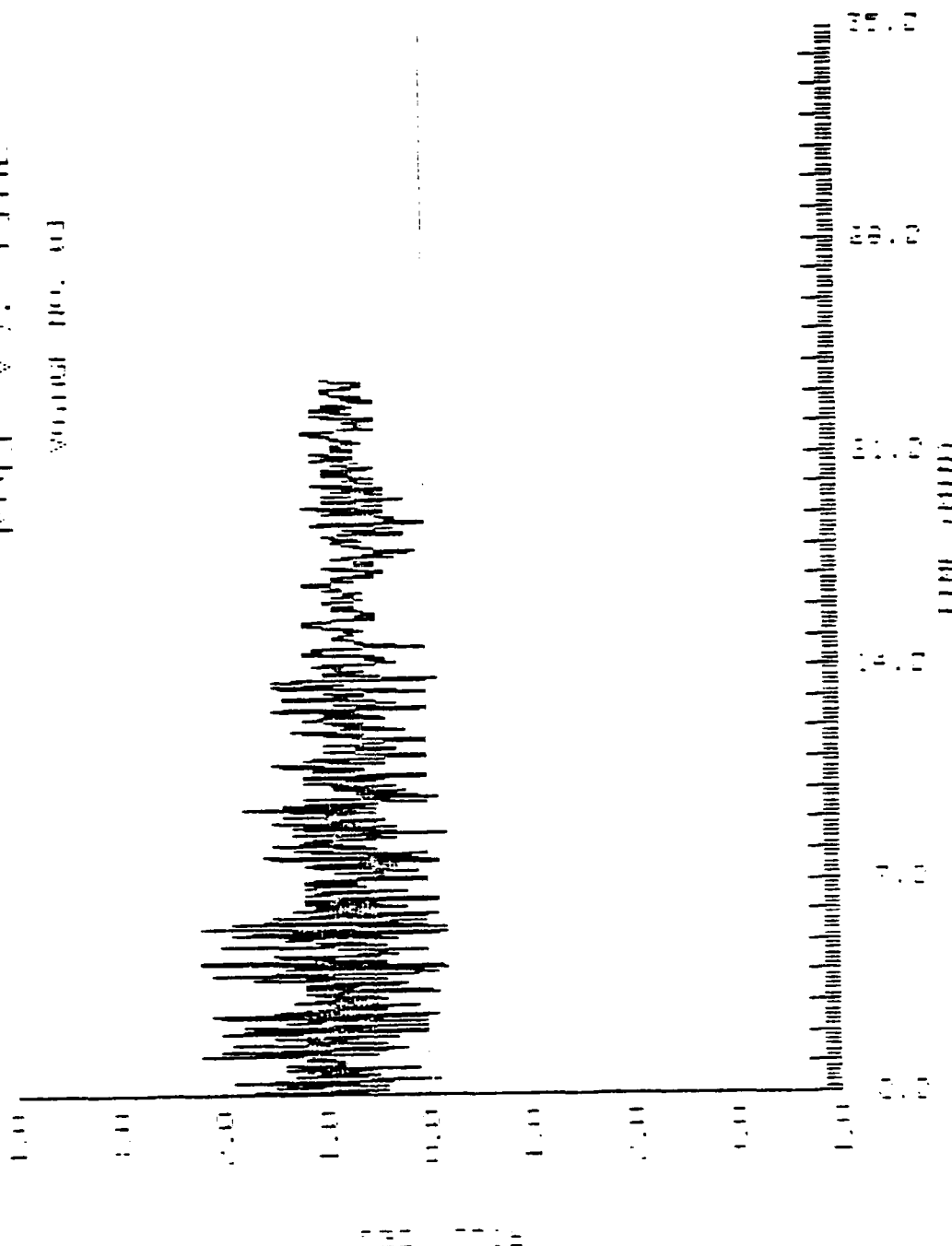
100  
 200  
 300  
 400  
 500  
 600  
 700  
 800  
 900  
 1000

1000 1000



# 1901 V. A. THE

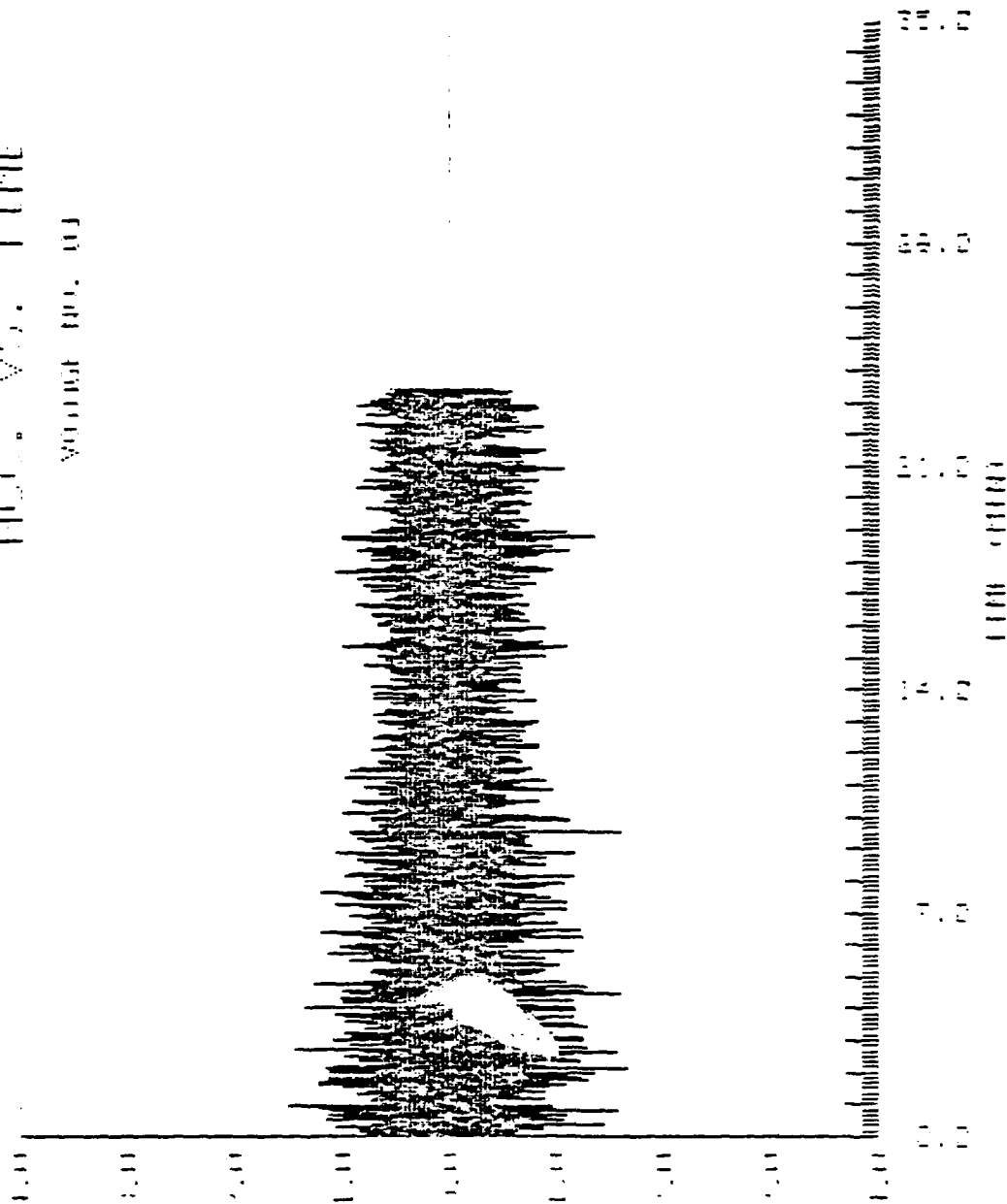
Volume No. 10





# FIG. 10. TIME

WIND NO. 11

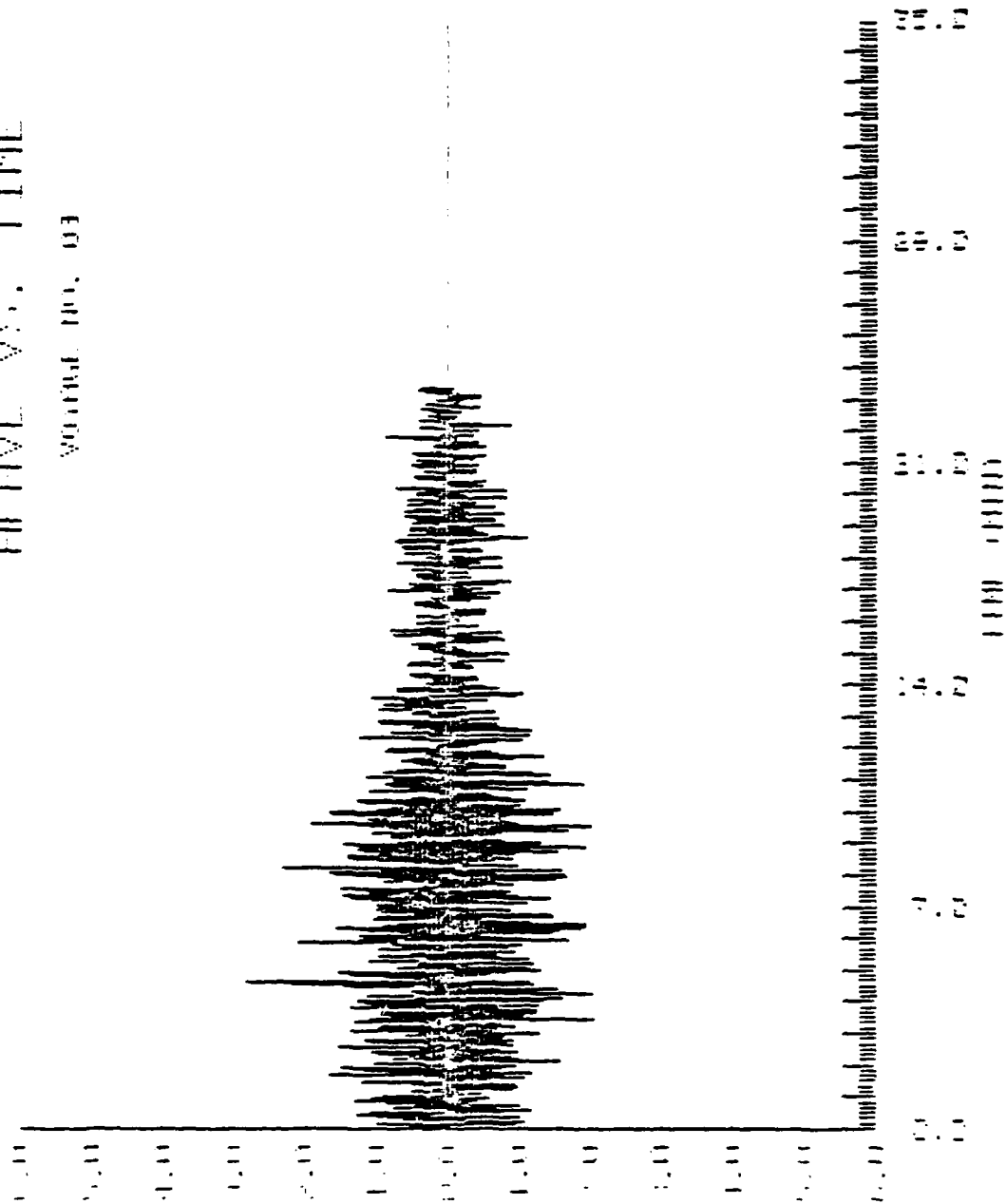


1.00 1.50 2.00



FIVE MIN. TIME

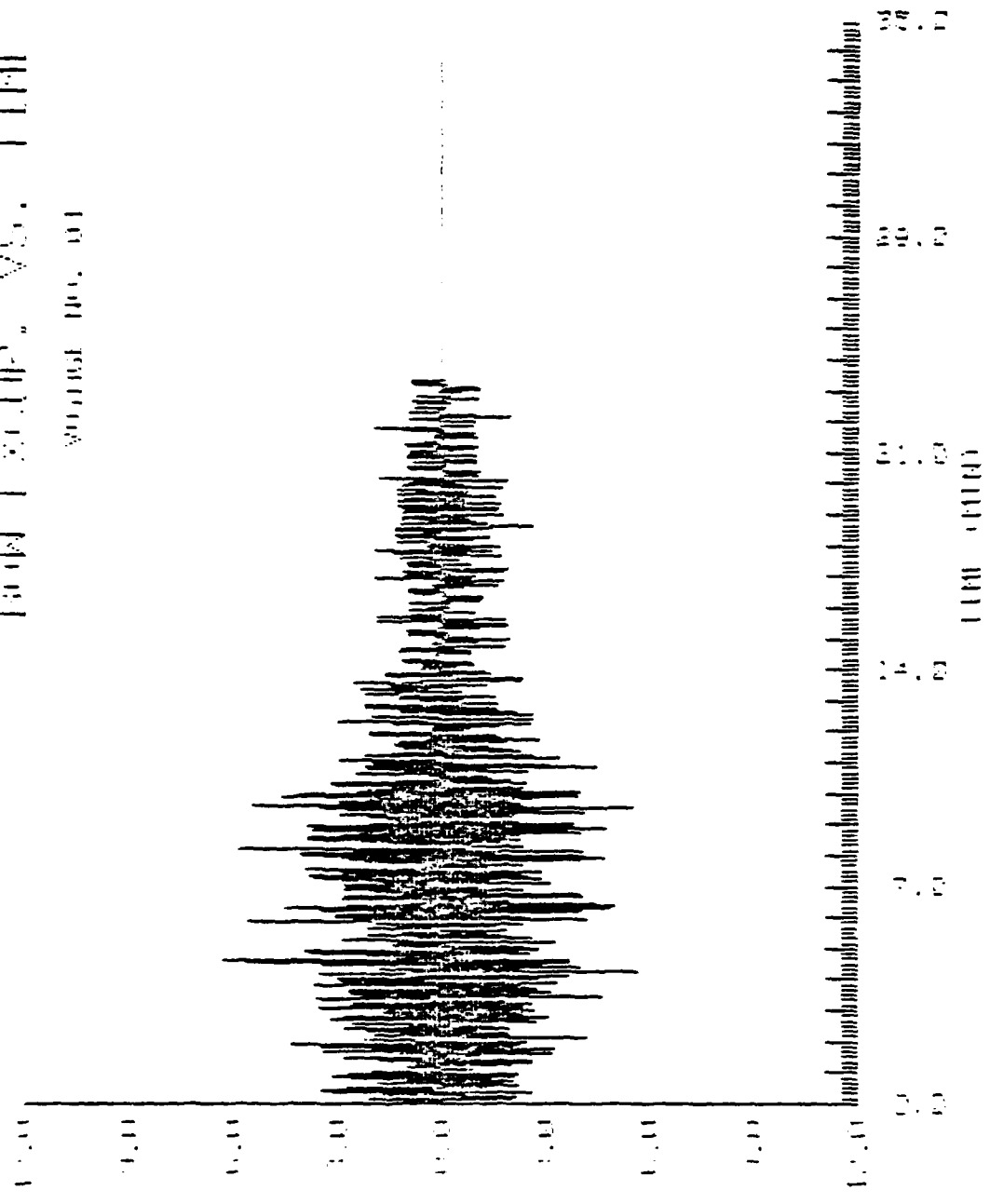
WOUND NO. 03





1004 1 20.00P. VS. TIME

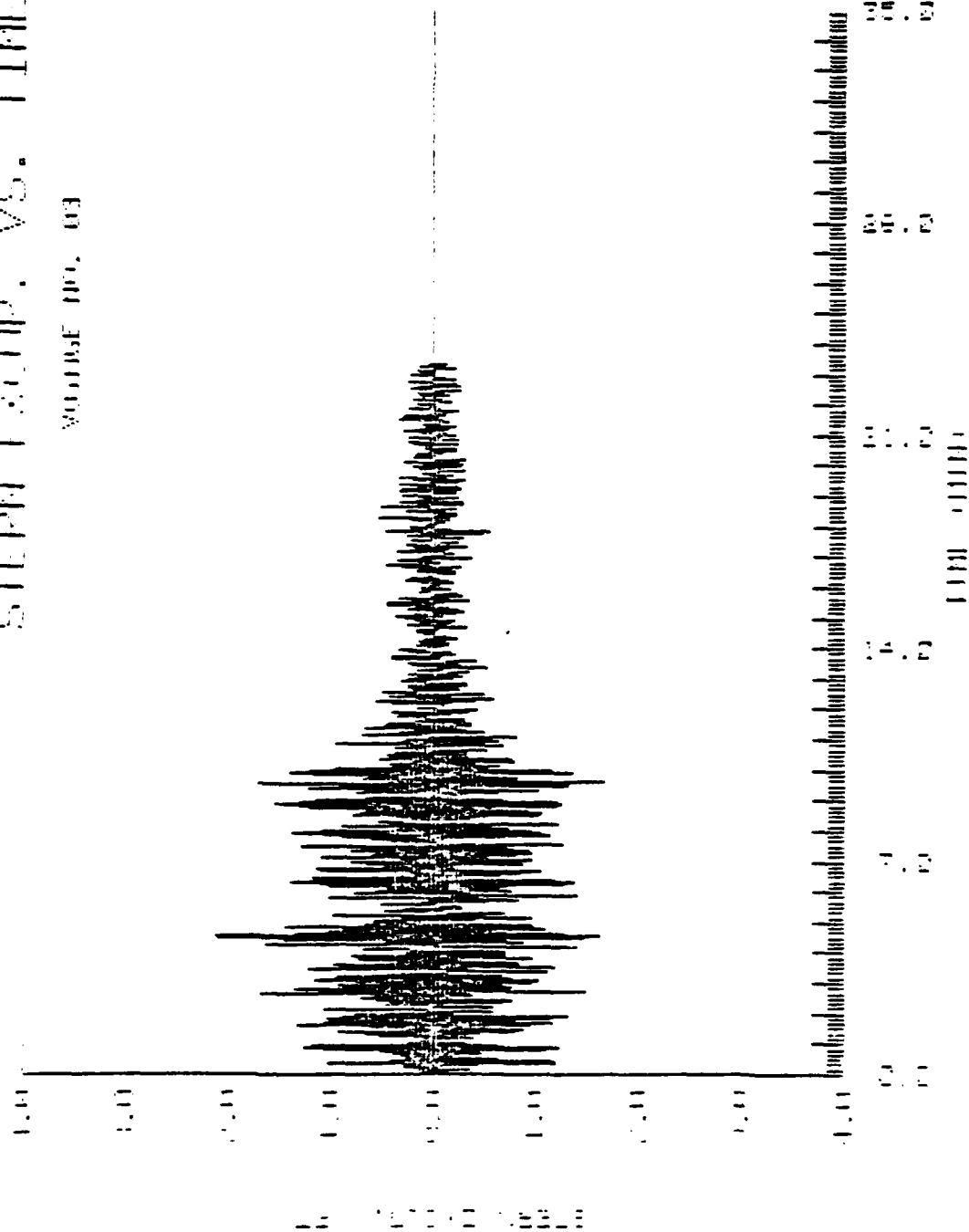
WIND NO. 01





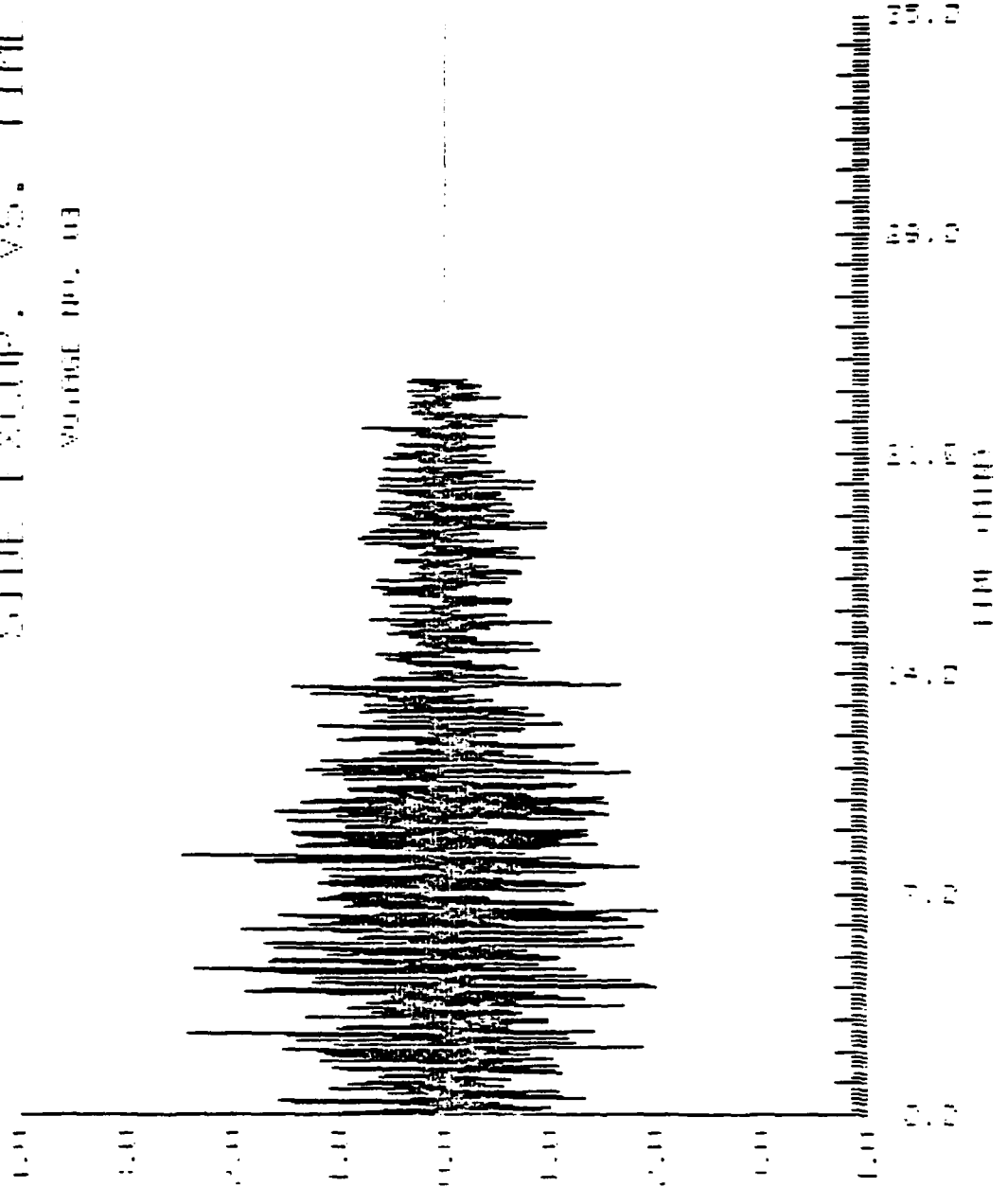
# STEPH EQUIP. VS. TIME

VOLUME 100, 03





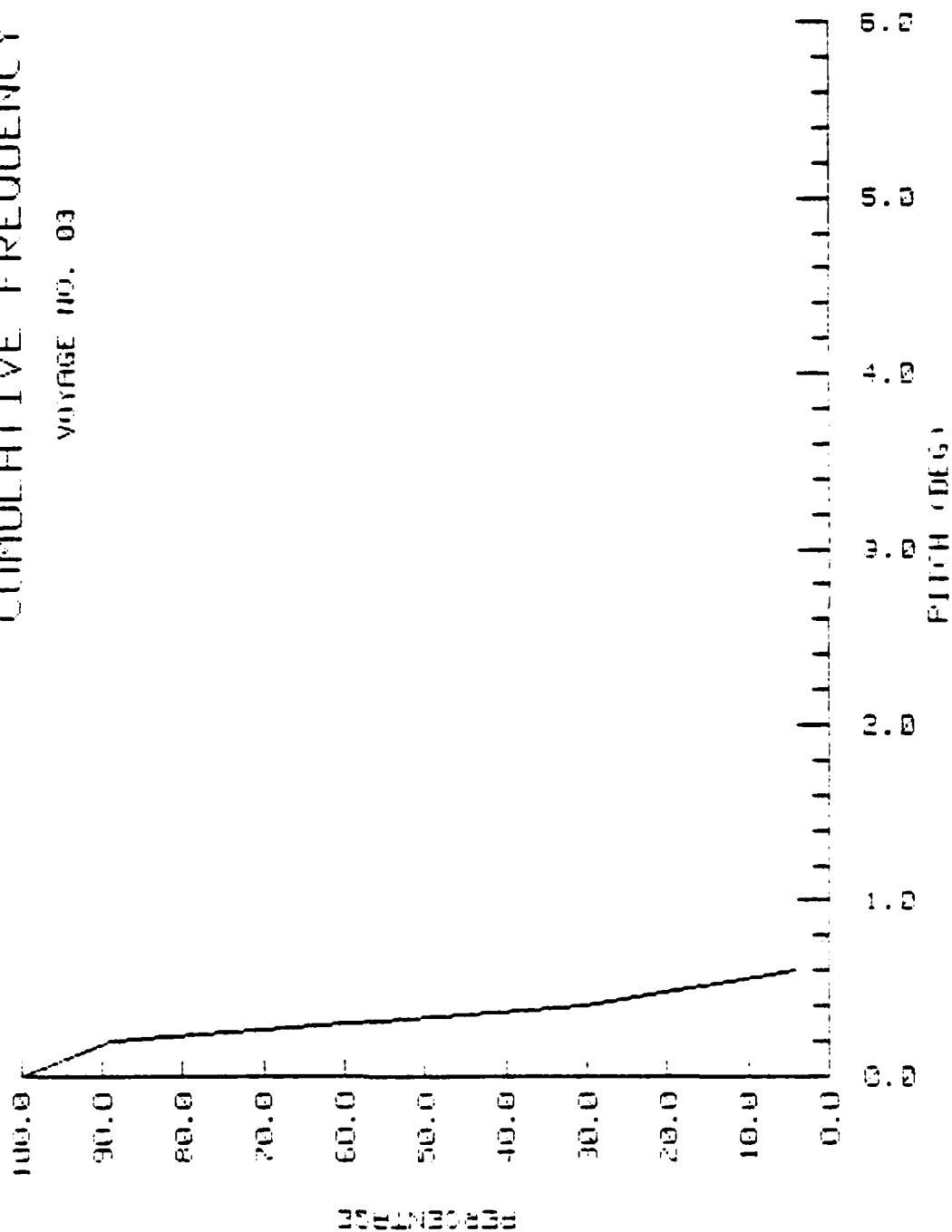
ENDING 11. 11





# CUMULATIVE FREQUENCY

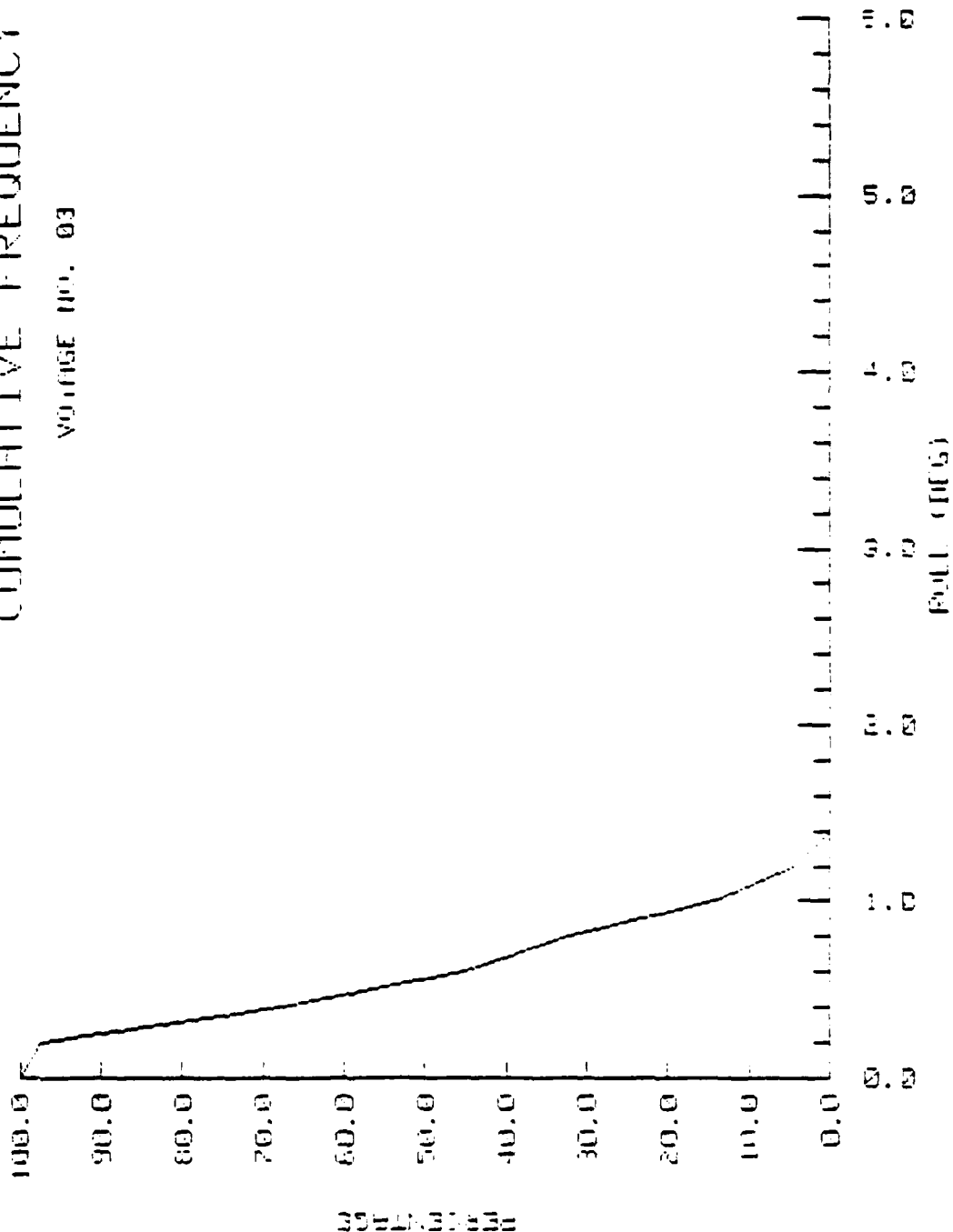
VOLTAJE NO. 03





# CUMULATIVE FREQUENCY

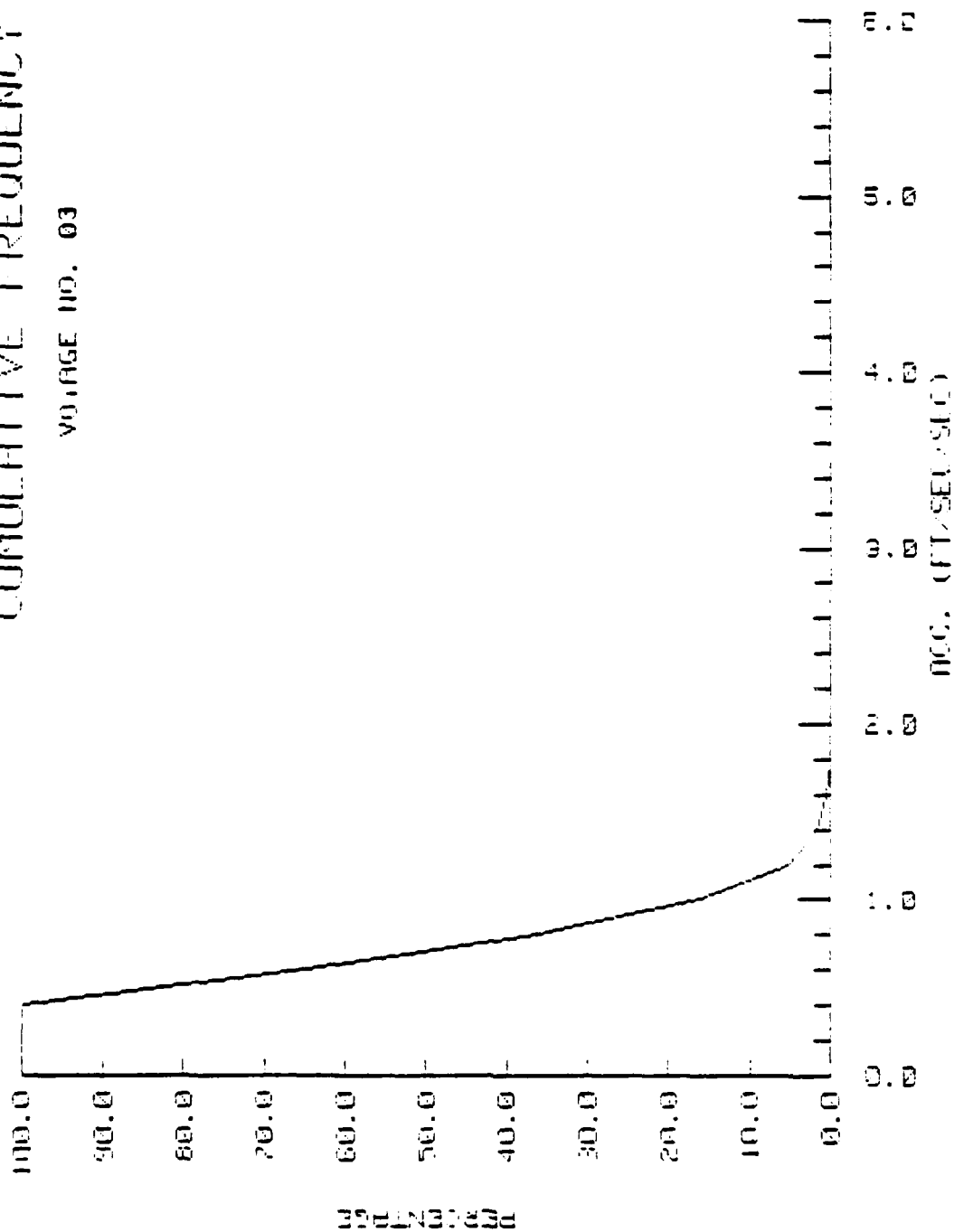
VOLUME NO. 03





# CUMULATIVE FREQUENCY

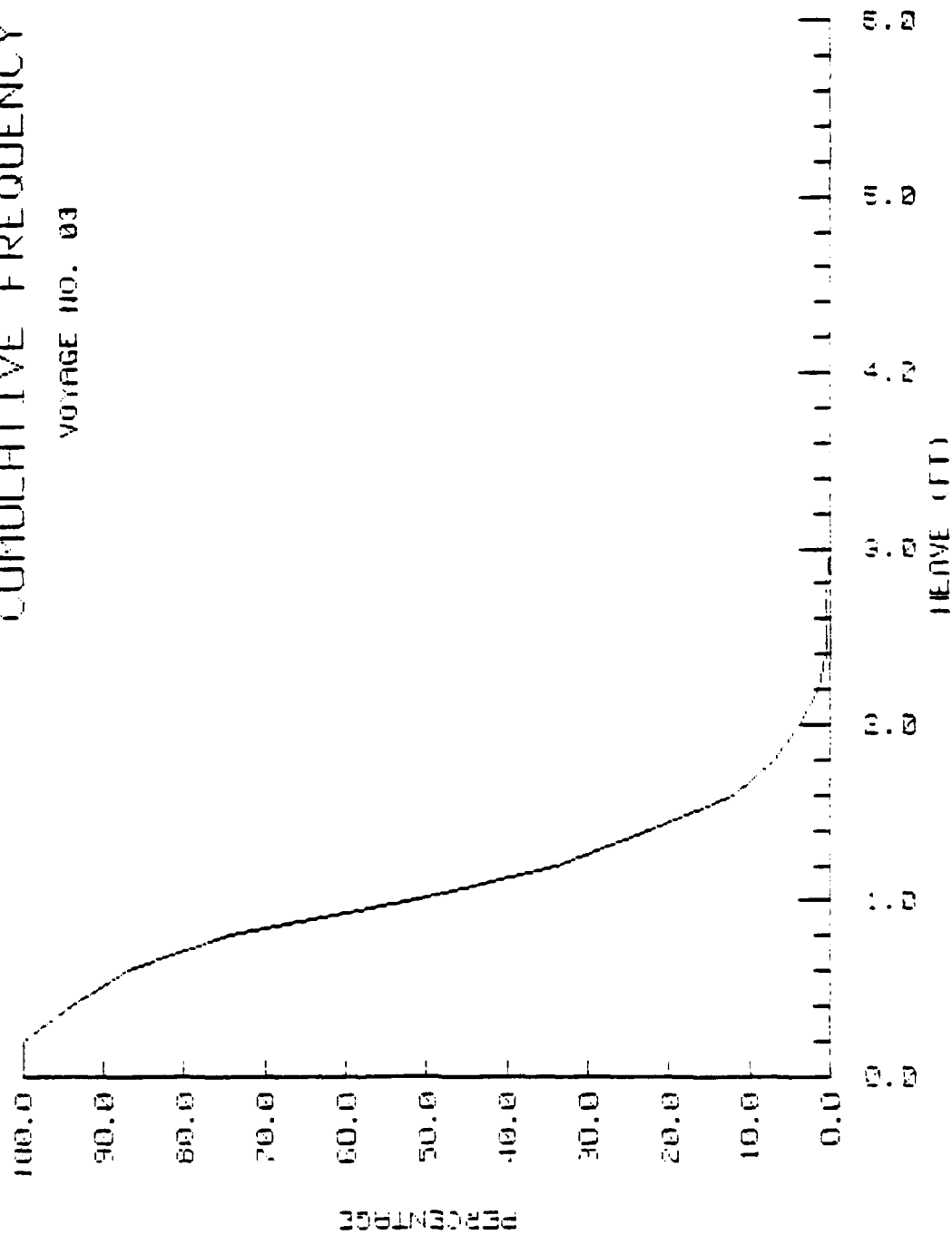
VOLAGE NO. 03





# CUMULATIVE FREQUENCY

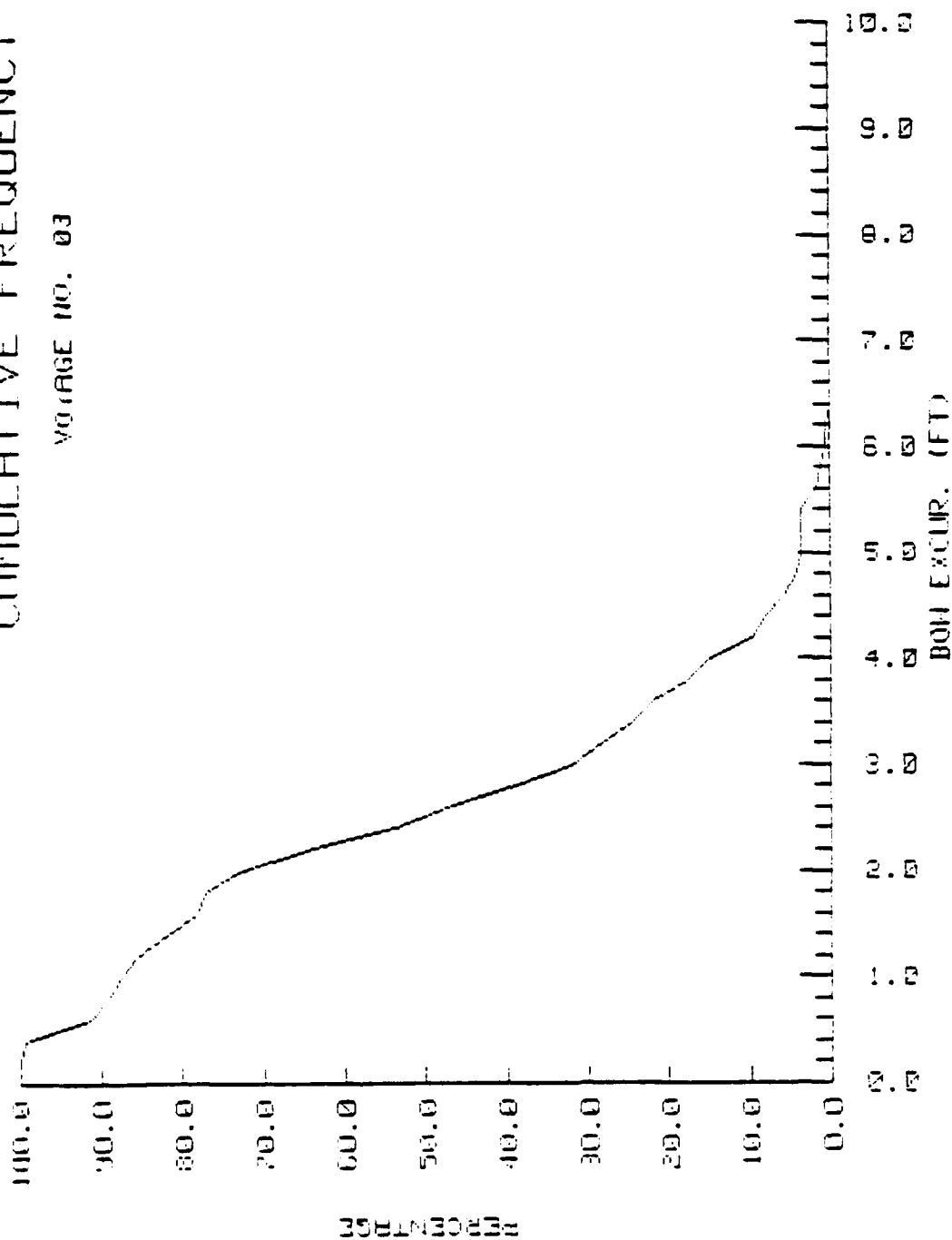
VOTAGE NO. 03





# CUMULATIVE FREQUENCY

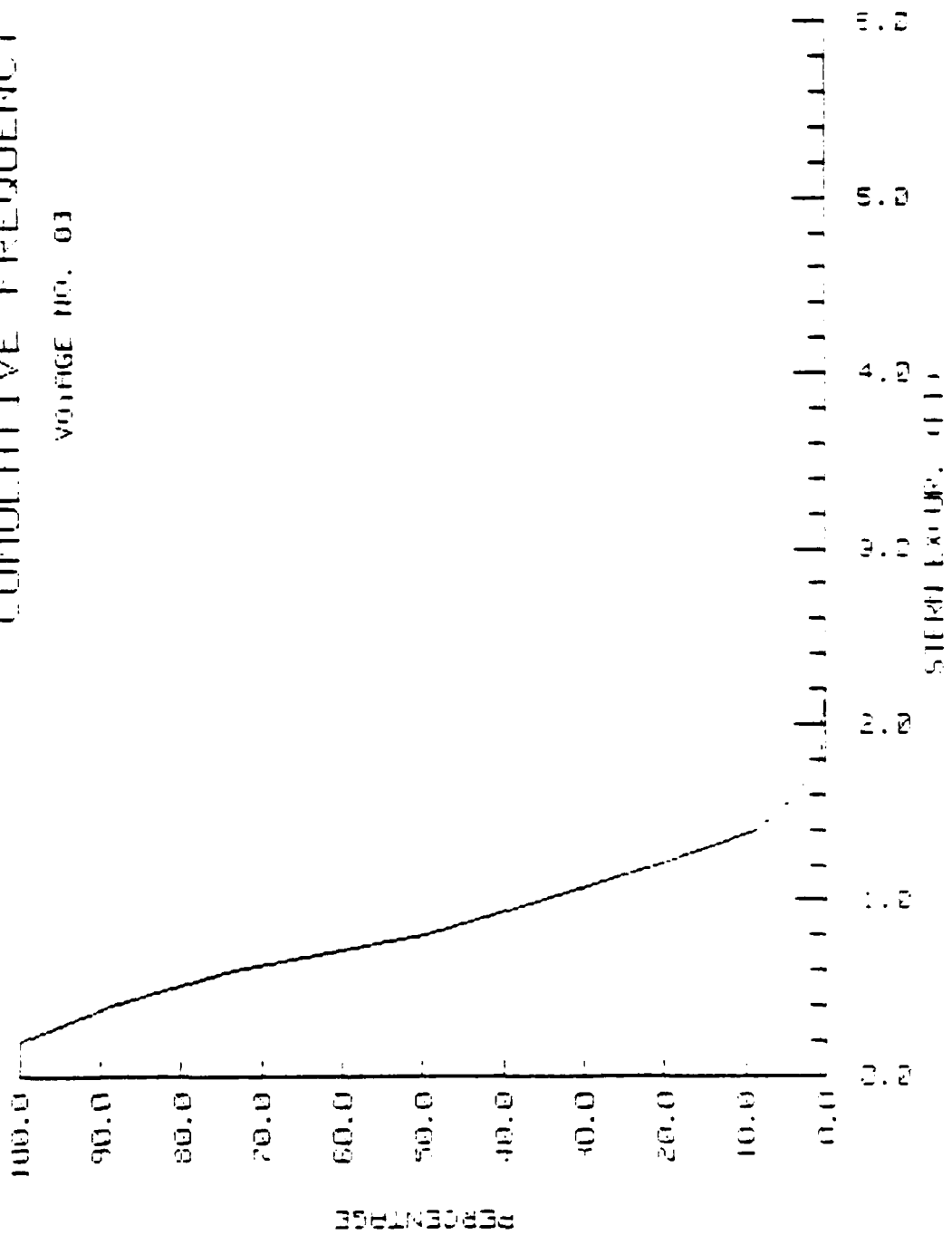
VOLAGE NO. 03





# CUMULATIVE FREQUENCY

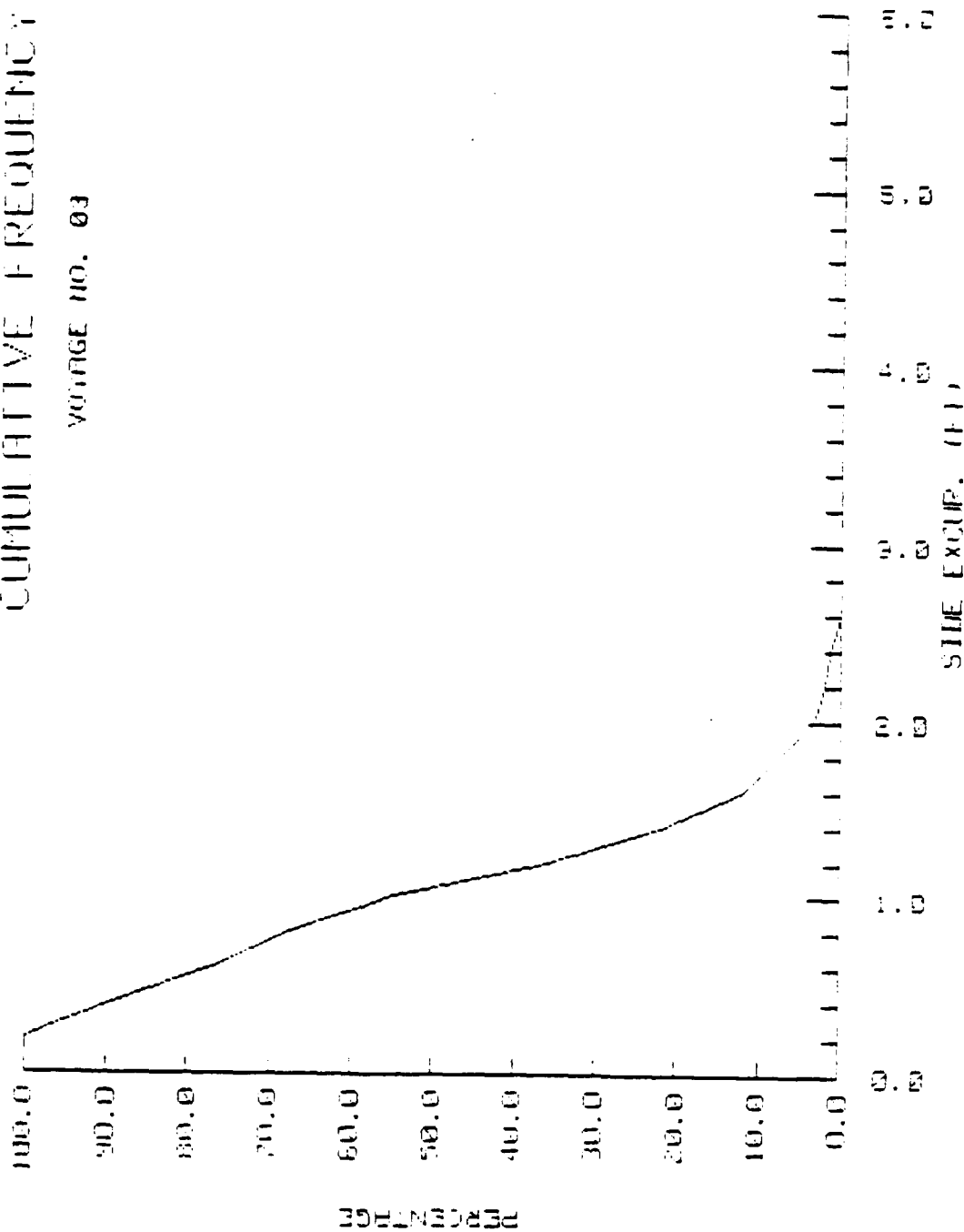
VOLUME NO. 03





# CUMULATIVE FREQUENCY

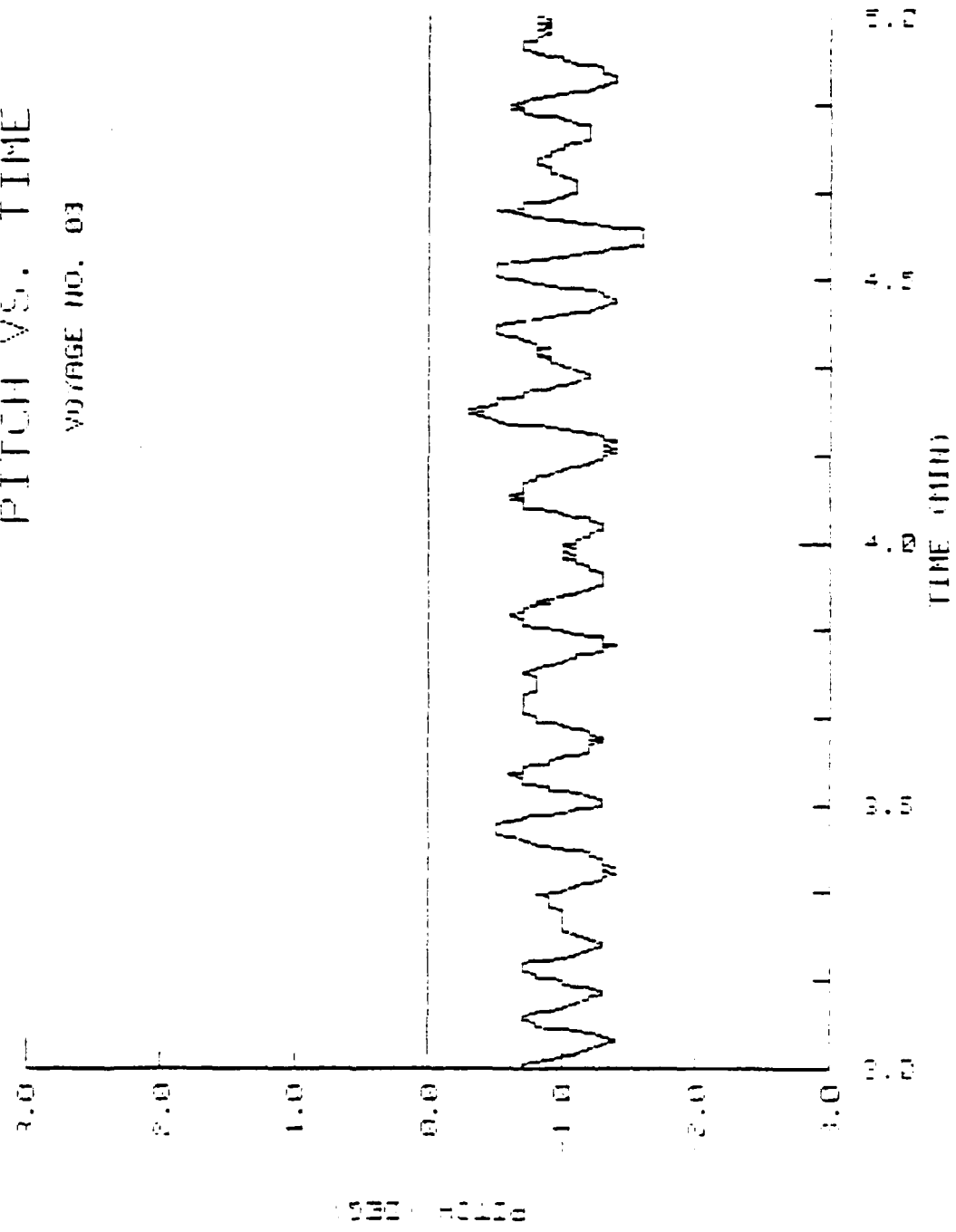
VOLUME NO. 03





# PITCH VS. TIME

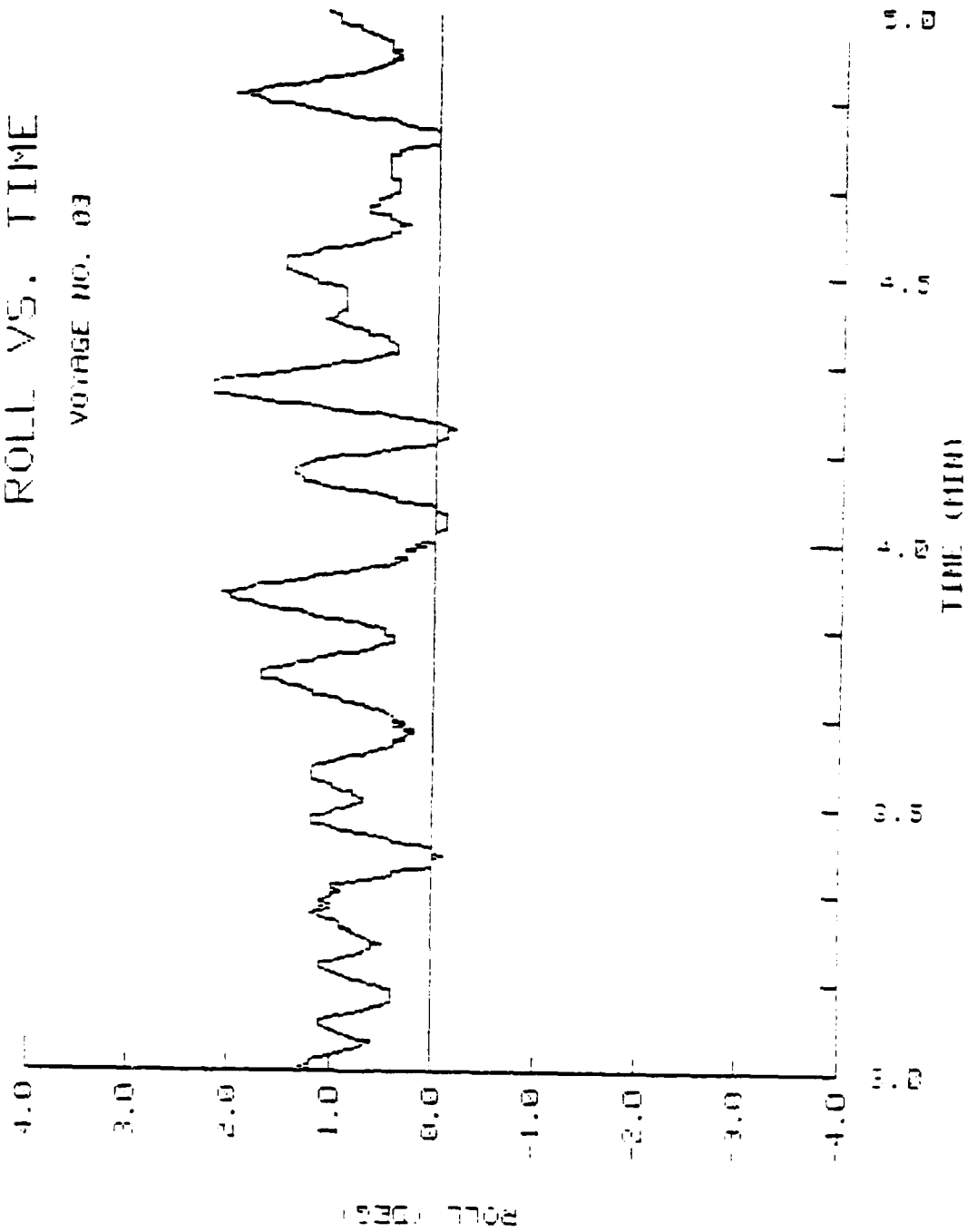
VOL/AGE NO. 03





# ROLL VS. TIME

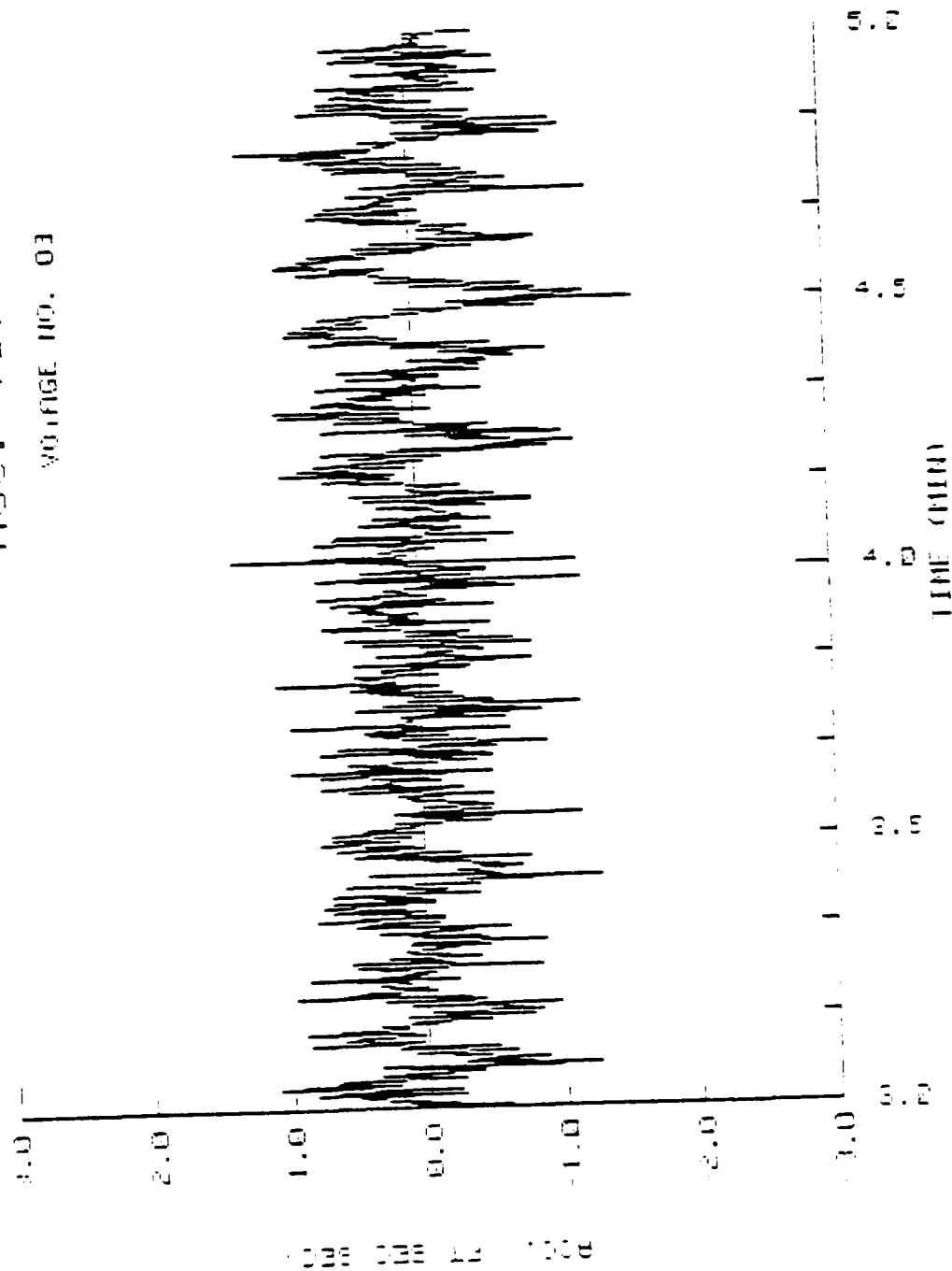
VOTAGE NO. 03





ACC. VS. TIME

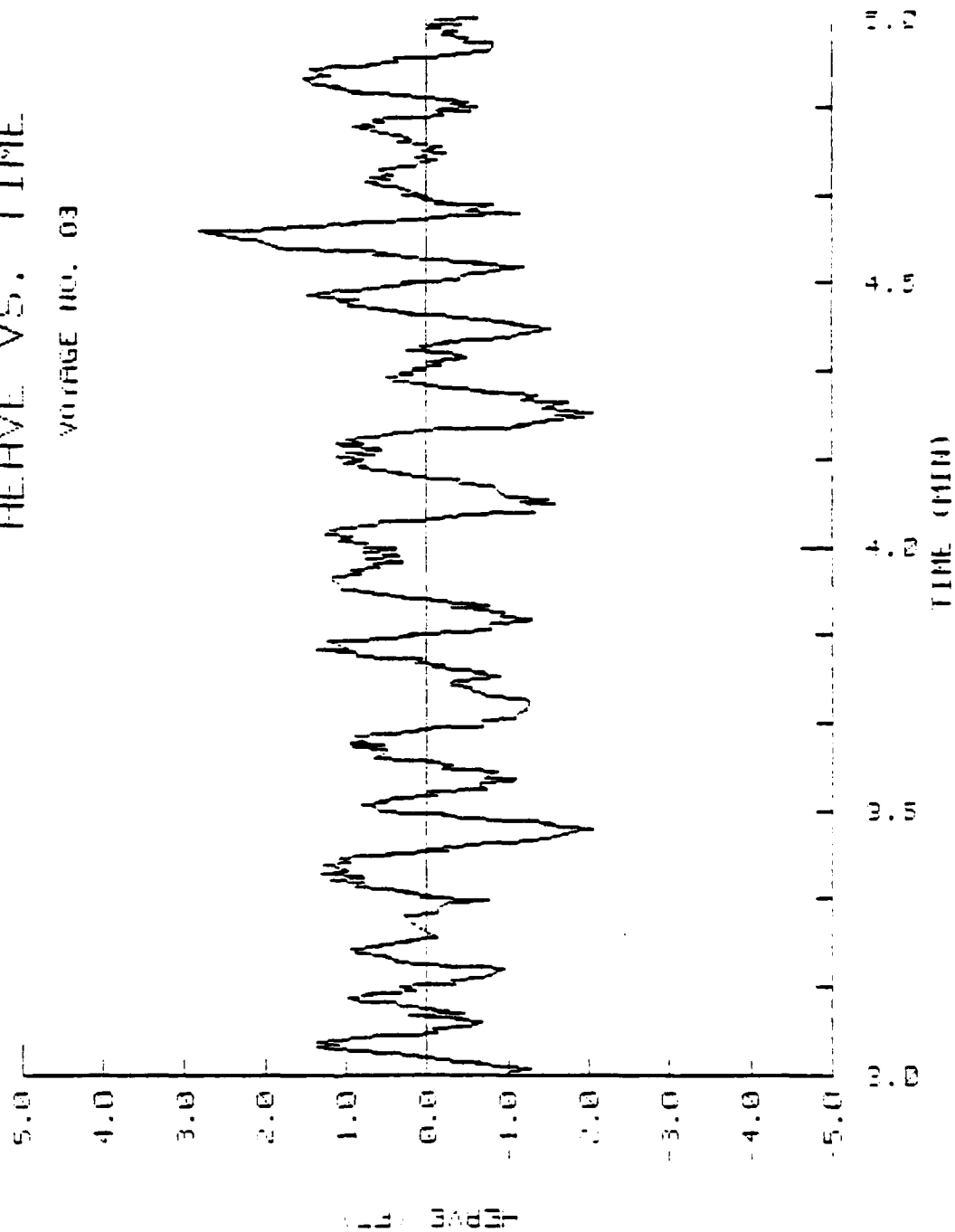
VOLUME NO. 03





# HEAVE VS. TIME

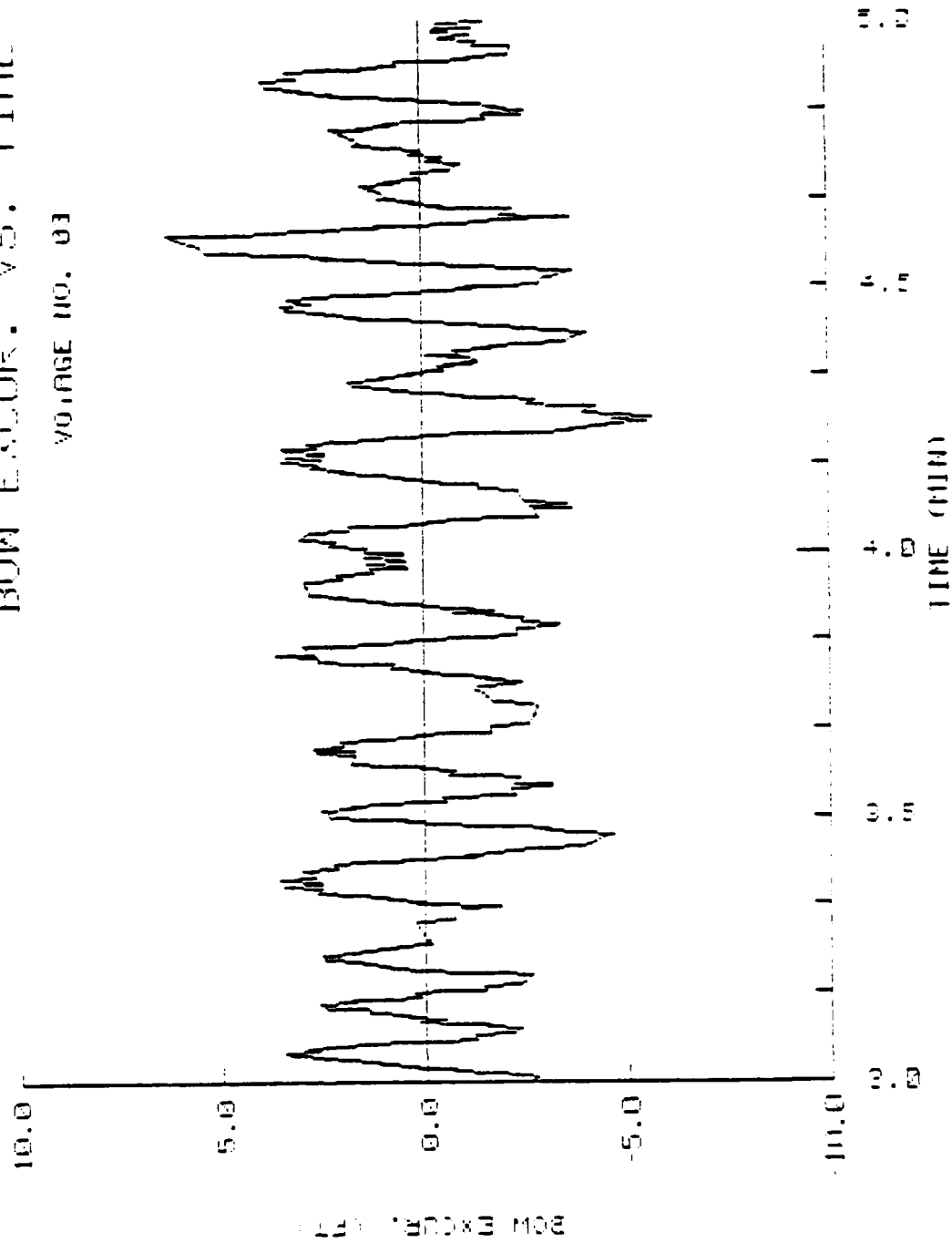
VOLTAGE NO. 03





BOW EXCUR. VS. TIME

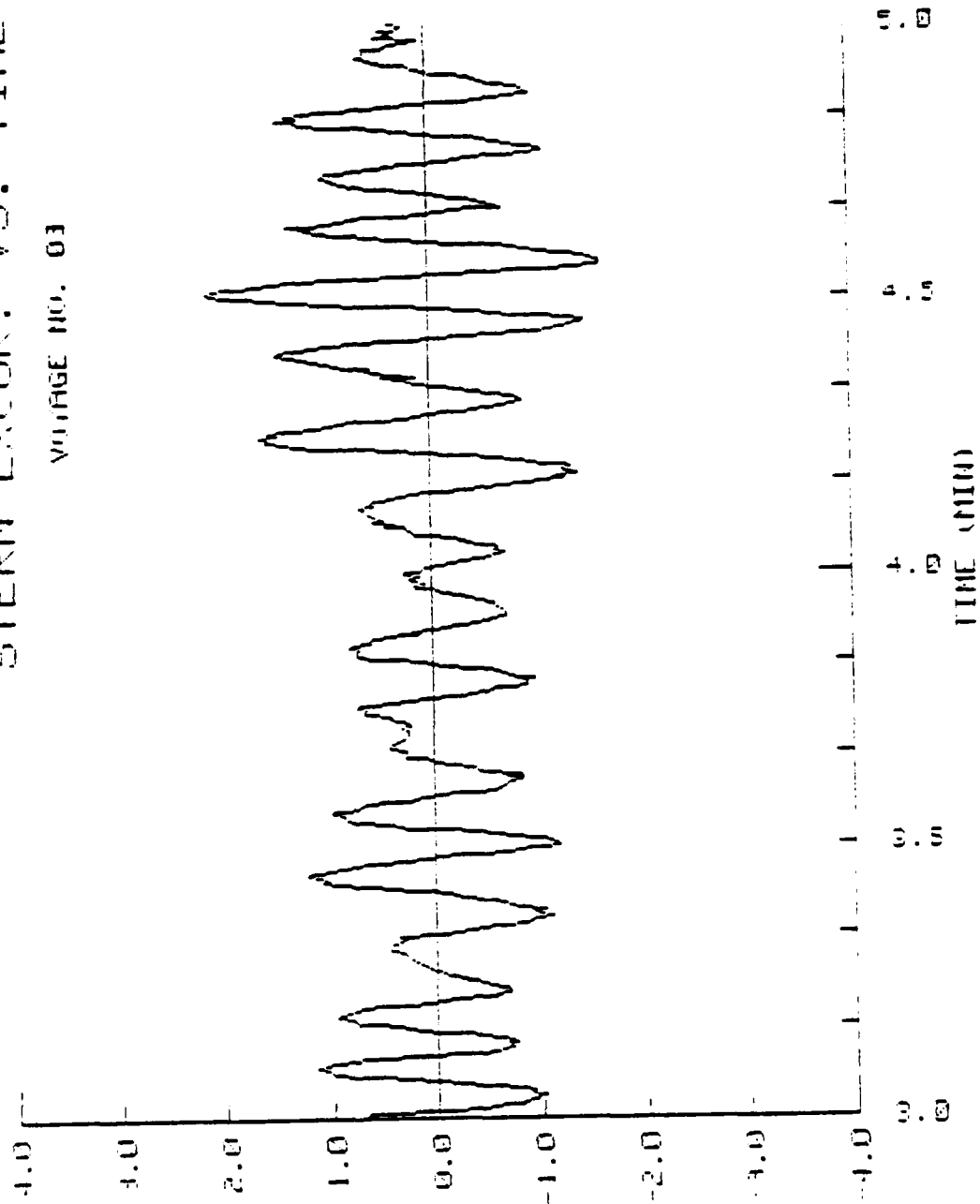
VOLUME NO. 03





# STERN EXCUR. VS. TIME

VOLUME NO. 03

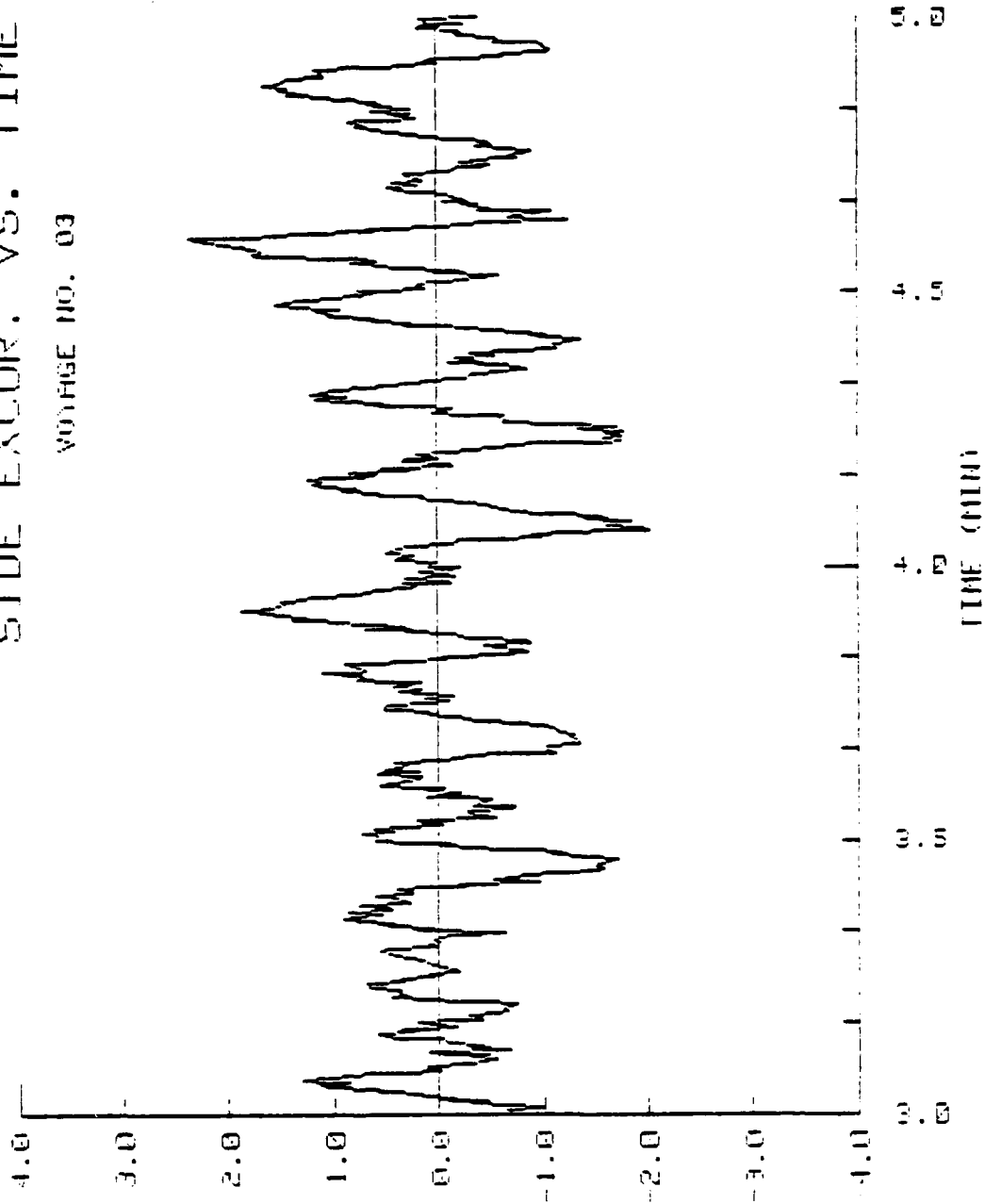


STERN EXCUR. (Y)



SIDE EXCUR. VS. TIME

VOICE NO. 03



SIDE EXCUR. (V)



# STATISTICAL SUMMARY

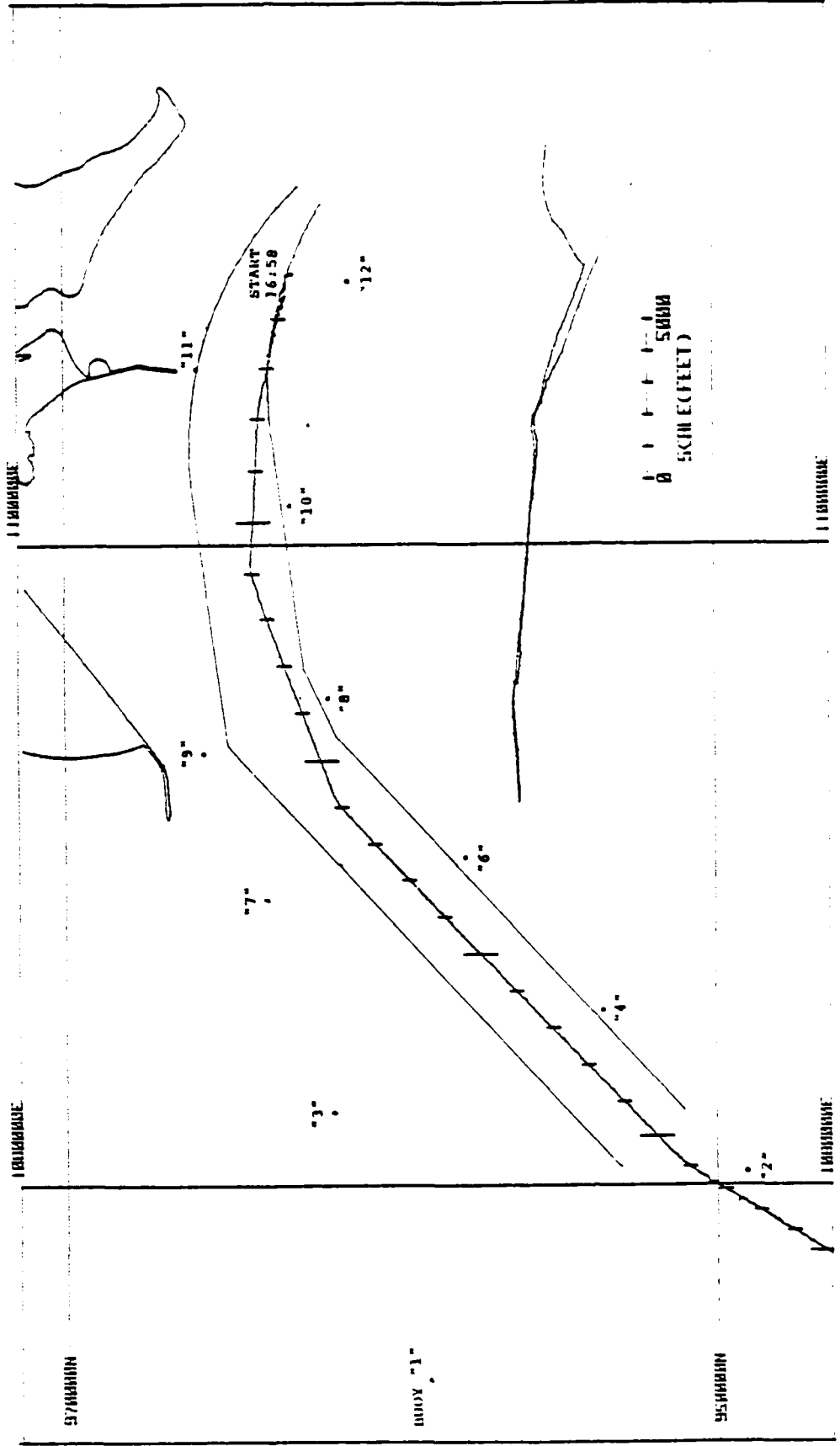
VOYAGE NO. 04

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.6	1.0	.4	.4
ROLL (DEG)	1.0	1.3	.4	.4
HEEL (FT/SEC/SEC)	-1.0	2.2	.7	.8
HEAVE (FT)	.0	4.1	1.5	1.6
FORE EXCUR. (FT)	.0	9.5	2.8	3.3
STERN EXCUR. (FT)	.0	1.8	.8	.8
STAR EXCUR (FT)	.0	4.1	1.4	1.6



# VILLAGE NO. 04 500' TRICK

ROUTE : 1 31025



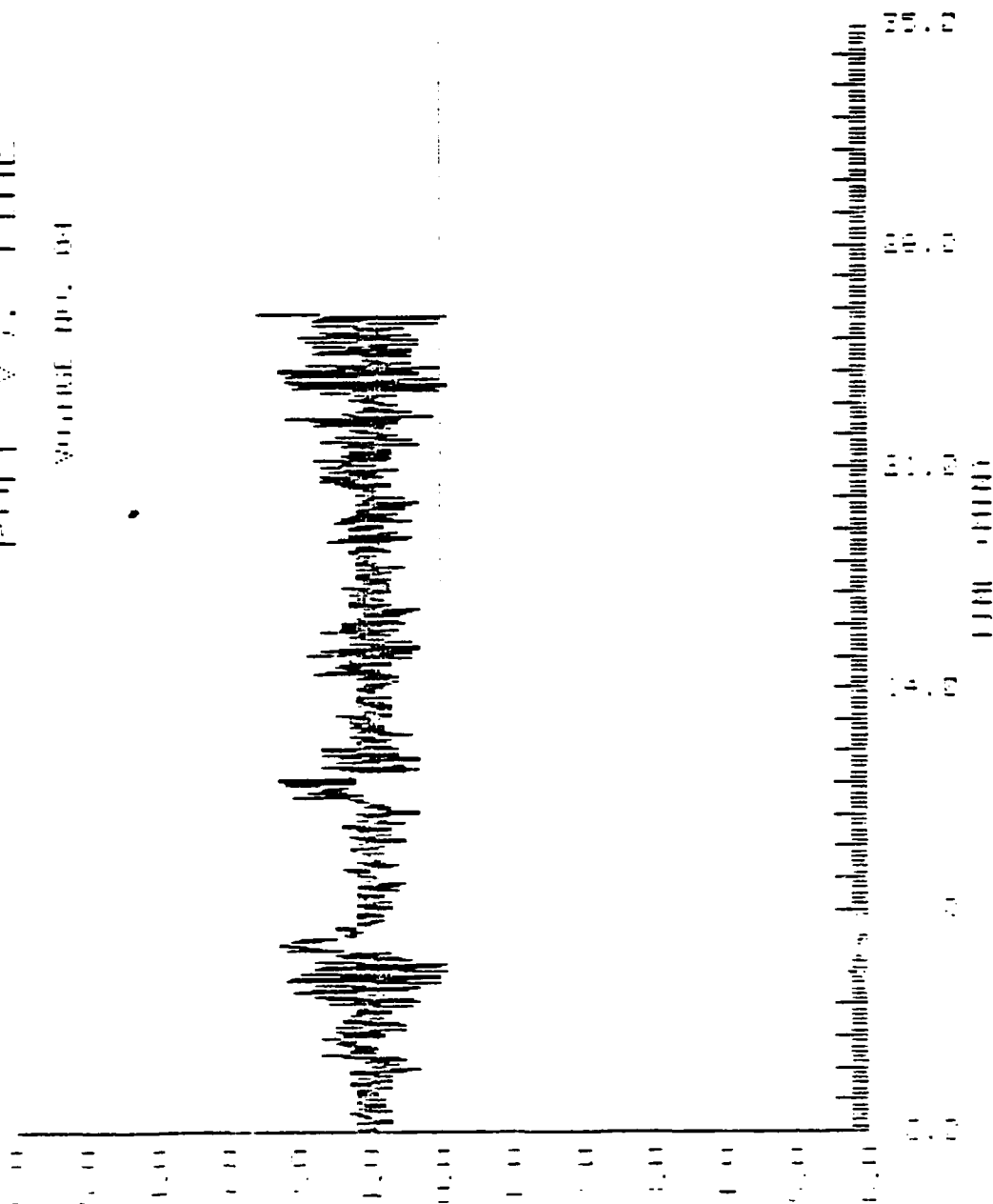






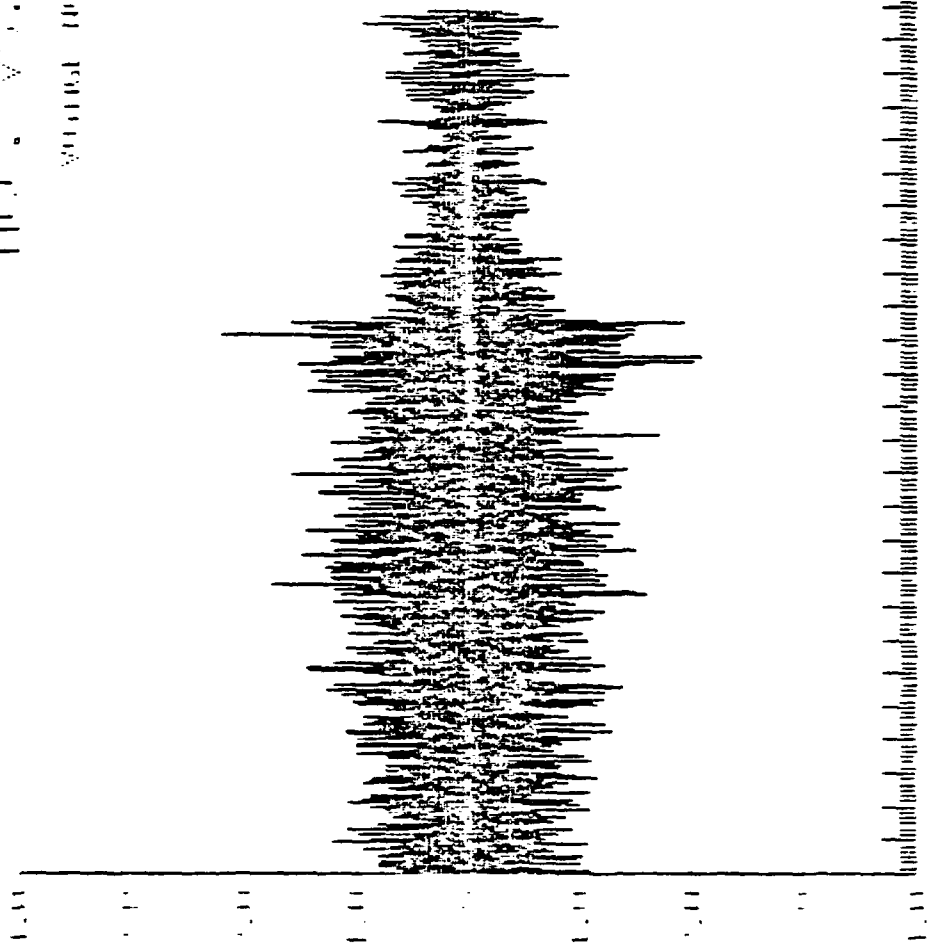
[illegible]

**WILLIAM W. BROWN**





111. V. 1111  
 100000 100. 00



1.00 1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22 1.23 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41 1.42 1.43 1.44 1.45 1.46 1.47 1.48 1.49 1.50 1.51 1.52 1.53 1.54 1.55 1.56 1.57 1.58 1.59 1.60 1.61 1.62 1.63 1.64 1.65 1.66 1.67 1.68 1.69 1.70 1.71 1.72 1.73 1.74 1.75 1.76 1.77 1.78 1.79 1.80 1.81 1.82 1.83 1.84 1.85 1.86 1.87 1.88 1.89 1.90 1.91 1.92 1.93 1.94 1.95 1.96 1.97 1.98 1.99 2.00

1.00 1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22 1.23 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41 1.42 1.43 1.44 1.45 1.46 1.47 1.48 1.49 1.50 1.51 1.52 1.53 1.54 1.55 1.56 1.57 1.58 1.59 1.60 1.61 1.62 1.63 1.64 1.65 1.66 1.67 1.68 1.69 1.70 1.71 1.72 1.73 1.74 1.75 1.76 1.77 1.78 1.79 1.80 1.81 1.82 1.83 1.84 1.85 1.86 1.87 1.88 1.89 1.90 1.91 1.92 1.93 1.94 1.95 1.96 1.97 1.98 1.99 2.00



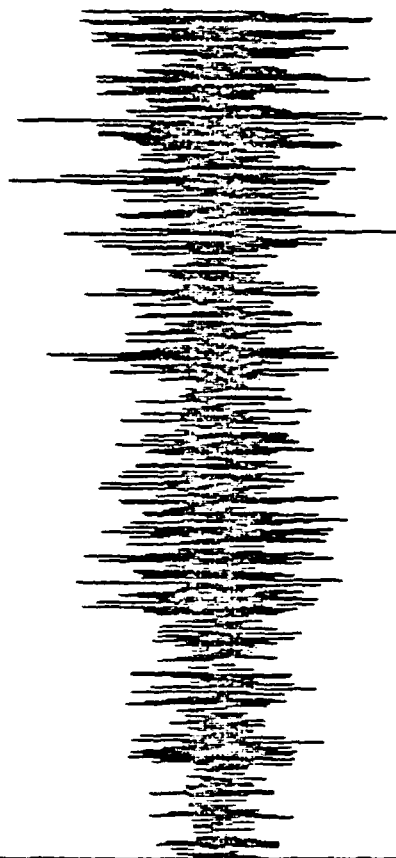




# HOW TO USE THE

VOICE RECORD

100.0  
100.0  
100.0  
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100.0  
100.0



100.0  
100.0  
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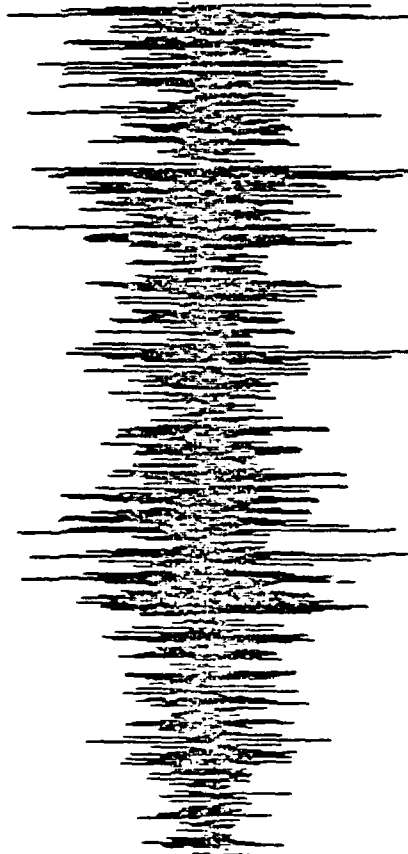
100.0  
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100.0

100.0



ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

DATE 10-10-01 BY 60322

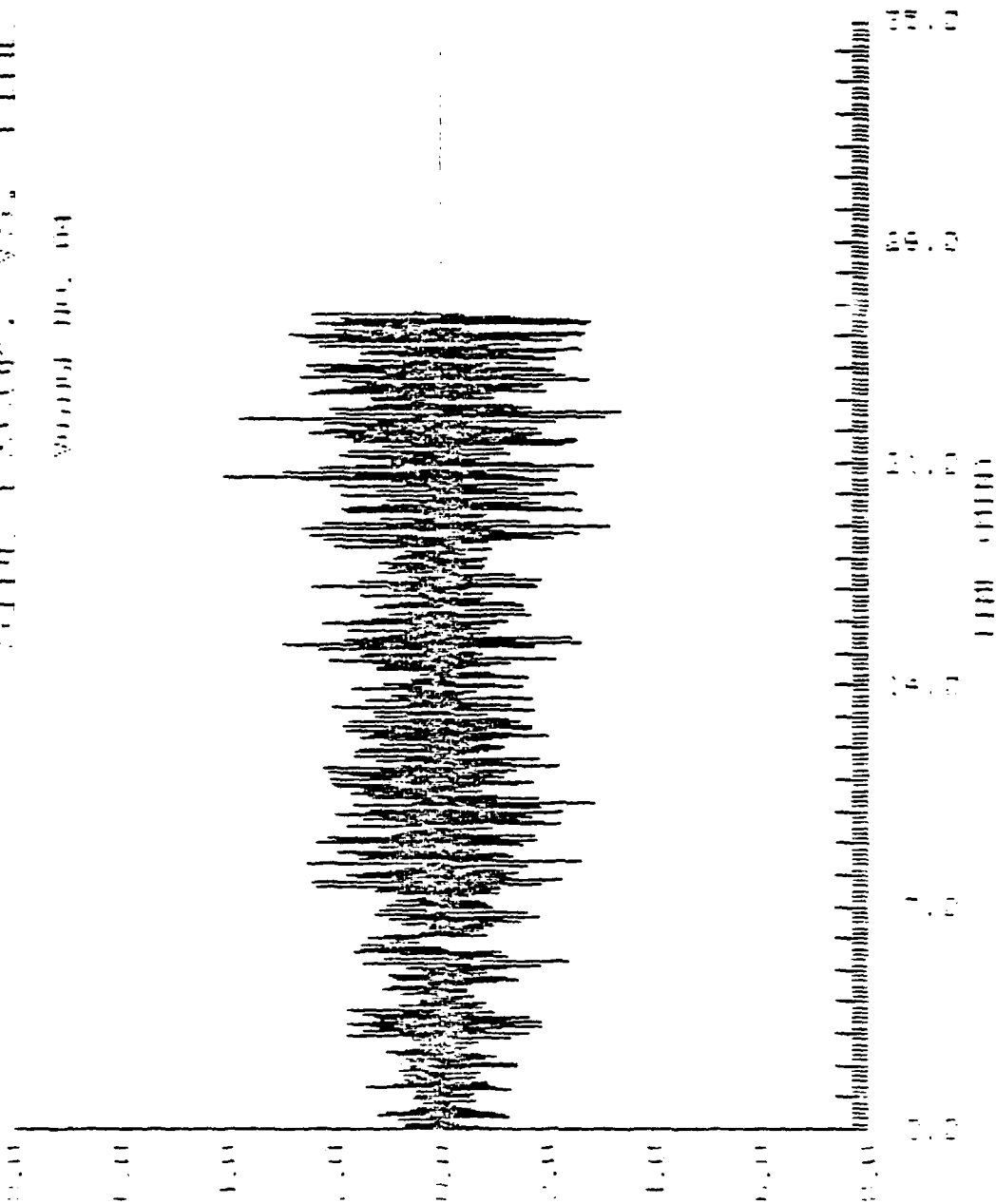


ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED  
DATE 10-10-01 BY 60322



1941-1942, Vol. 1111

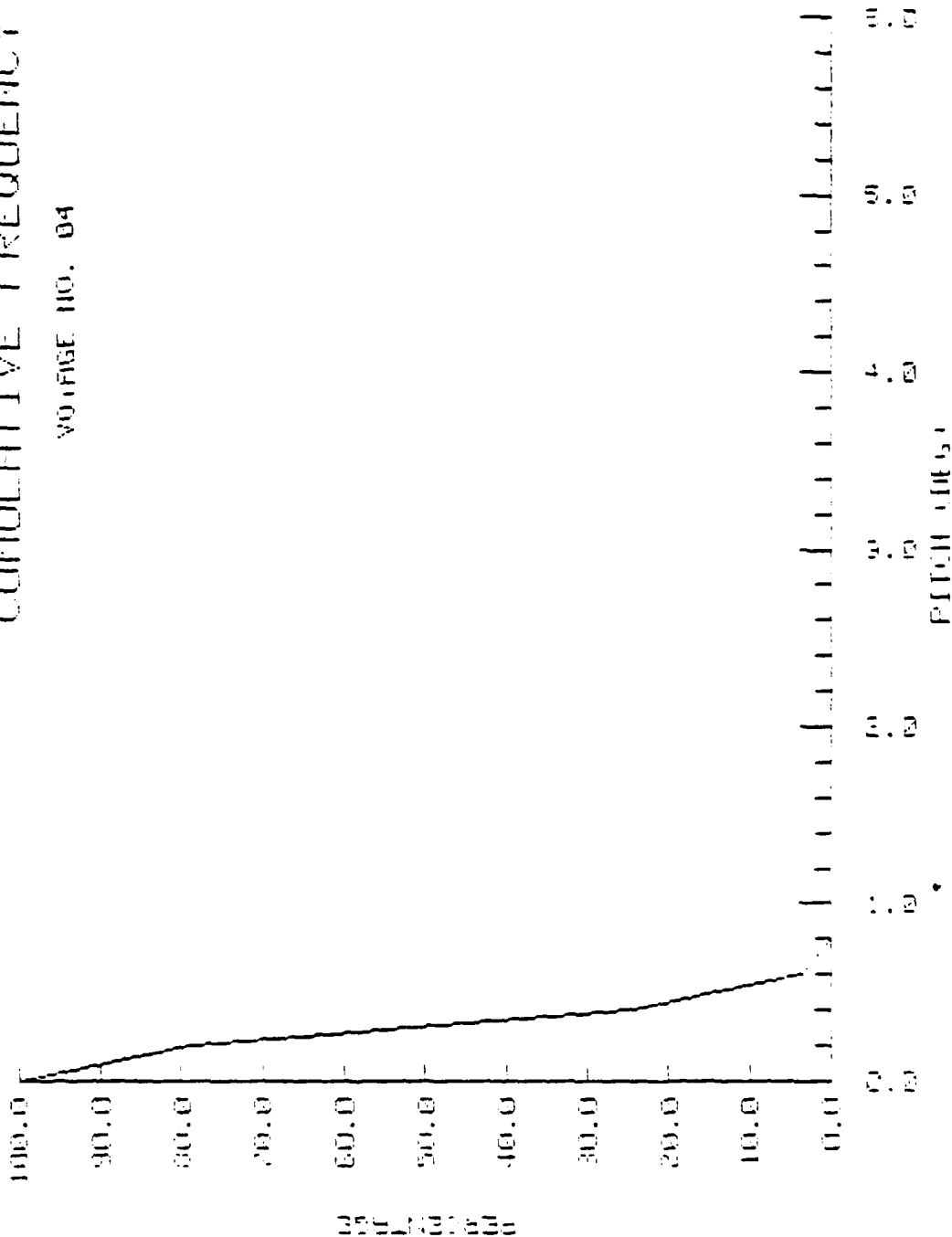
Wood No. 101





# CUMULATIVE FREQUENCY

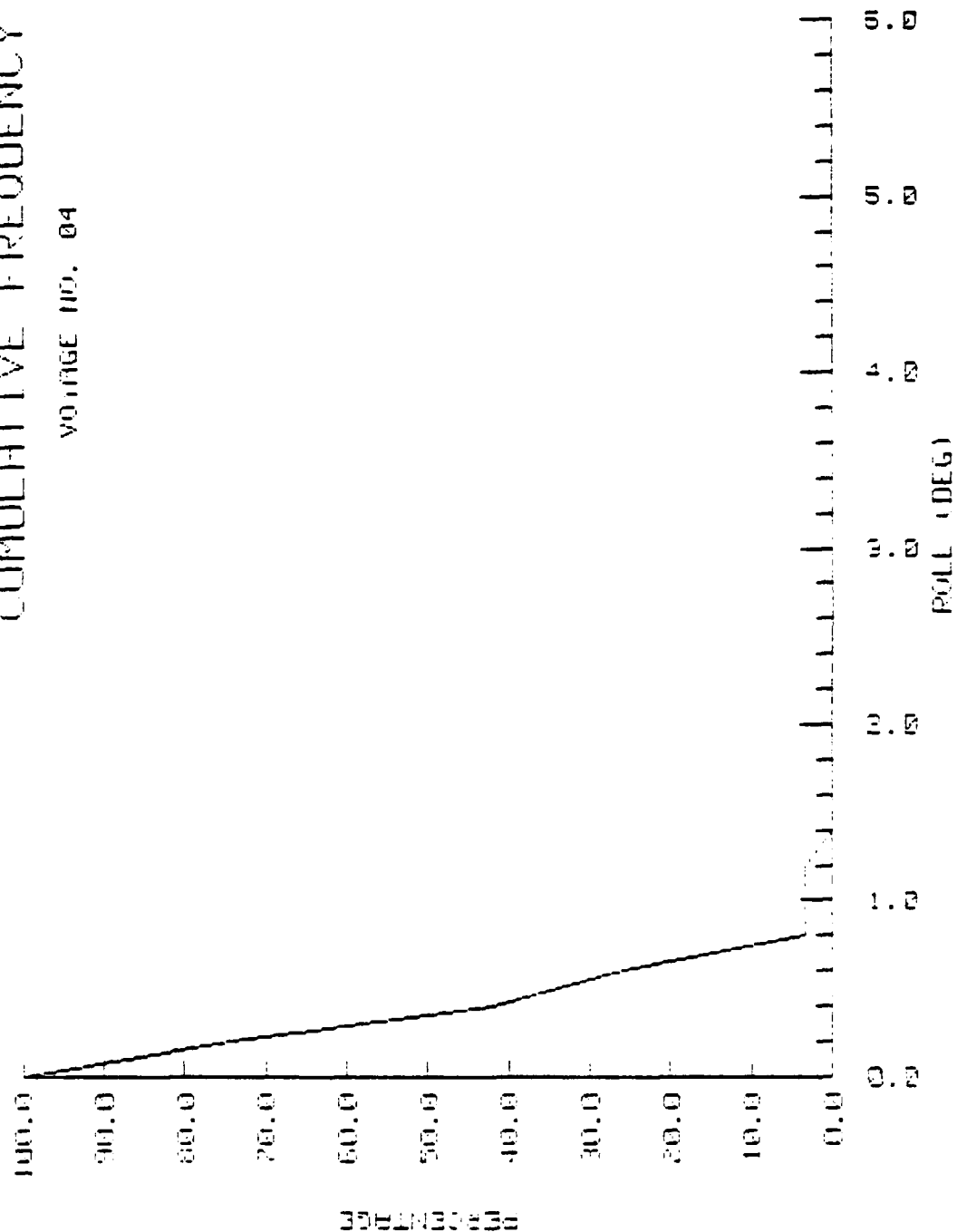
VOLUME NO. 04





# CUMULATIVE FREQUENCY

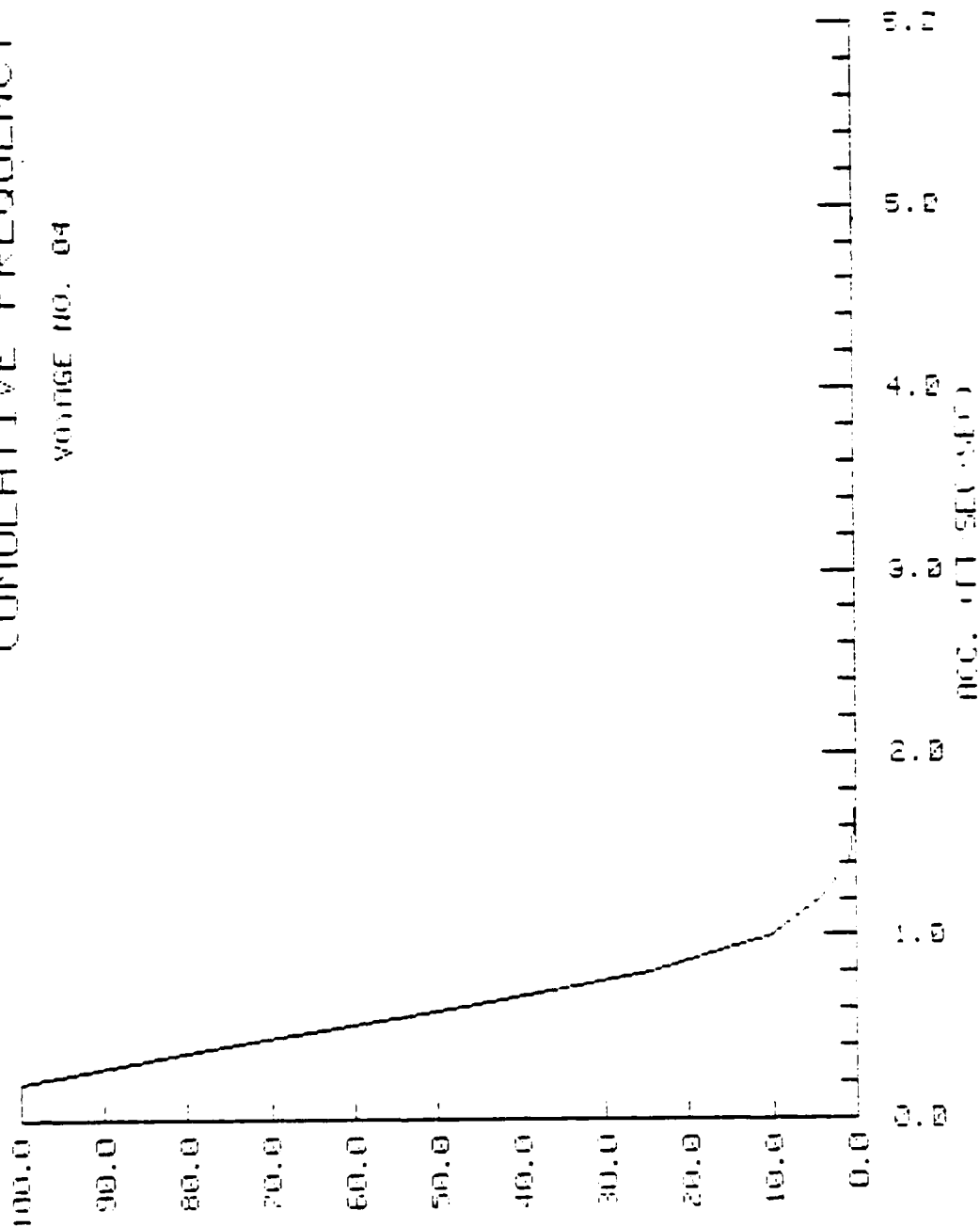
VOLUME NO. 04





# CUMULATIVE FREQUENCY

VOLUME NO. 04

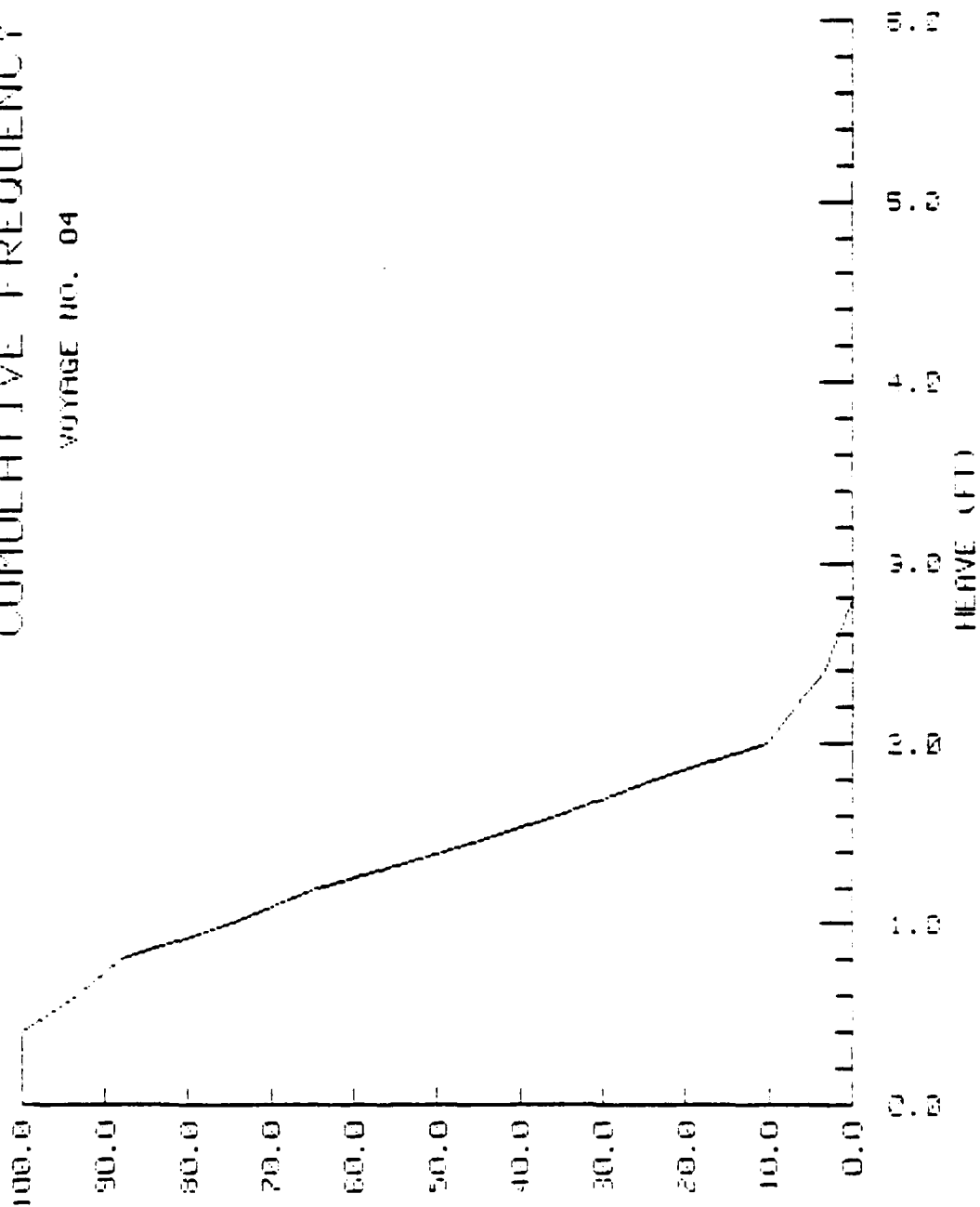


PERCENTAGE



# CUMULATIVE FREQUENCY

VOYAGE NO. 04

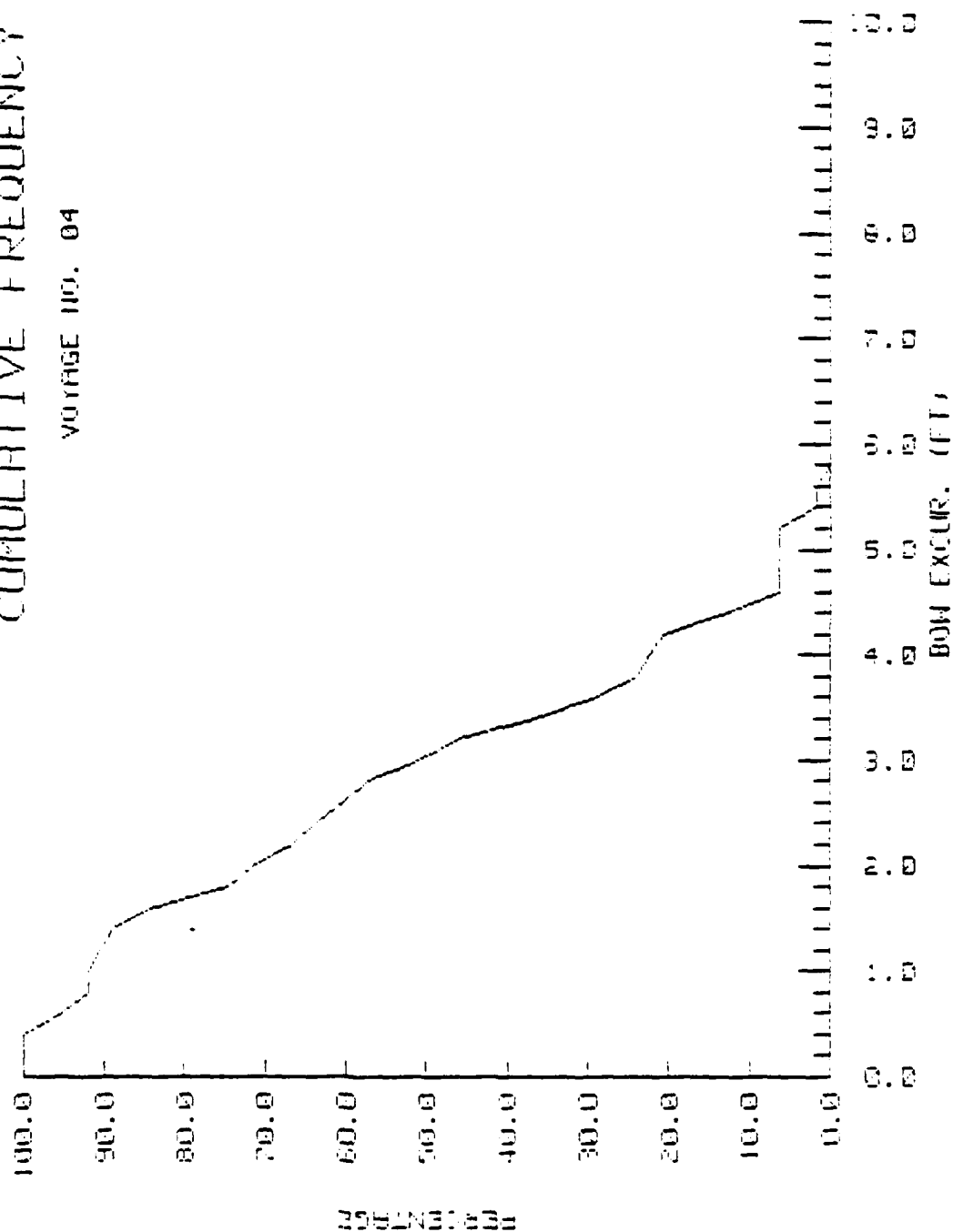


00 00 00 00 00 00 00 00 00 00



# CUMULATIVE FREQUENCY

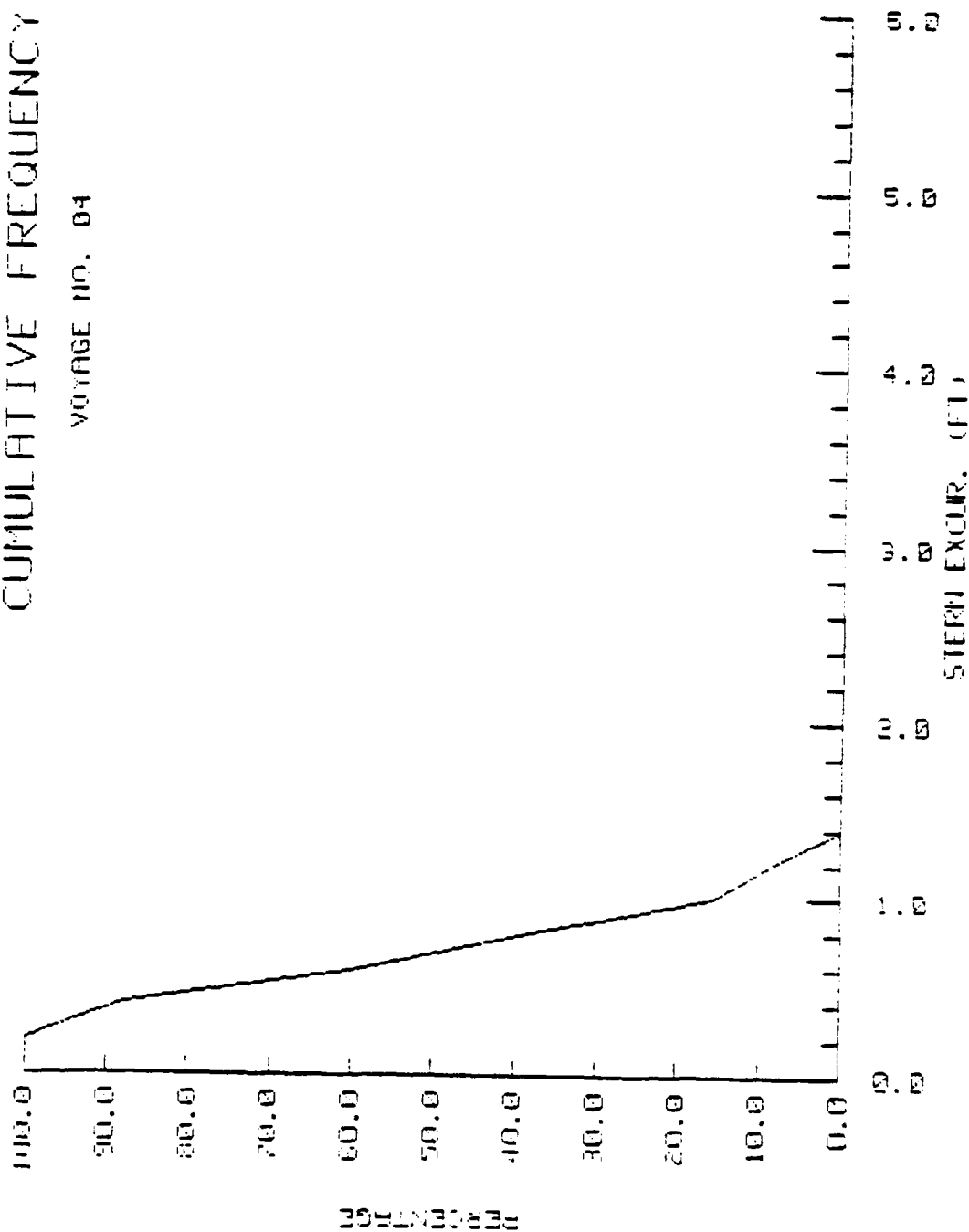
VOLAGE 110. 04





# CUMULATIVE FREQUENCY

VOYAGE NO. 04





# CUMULATIVE FREQUENCY

VOLUME NO. '04

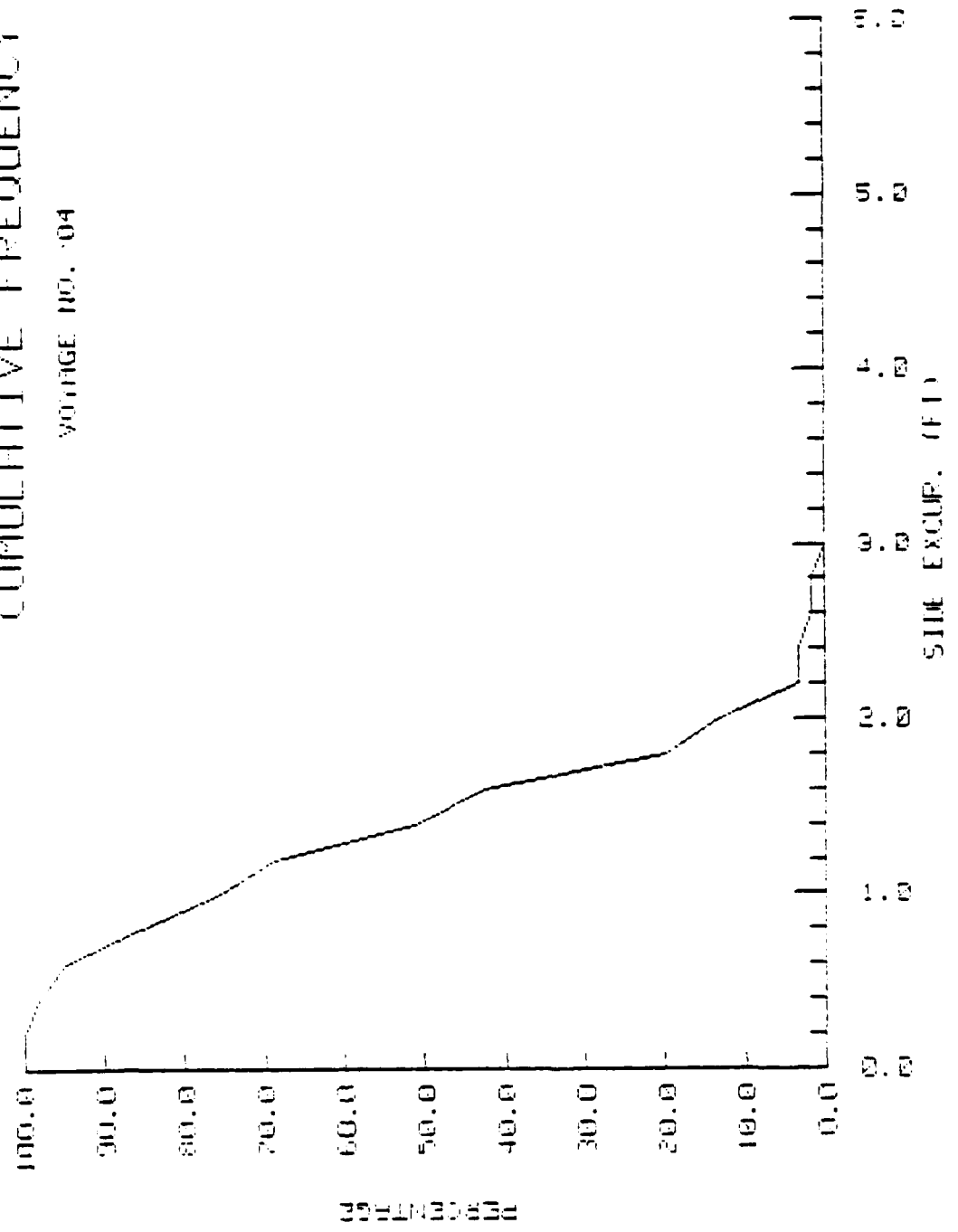
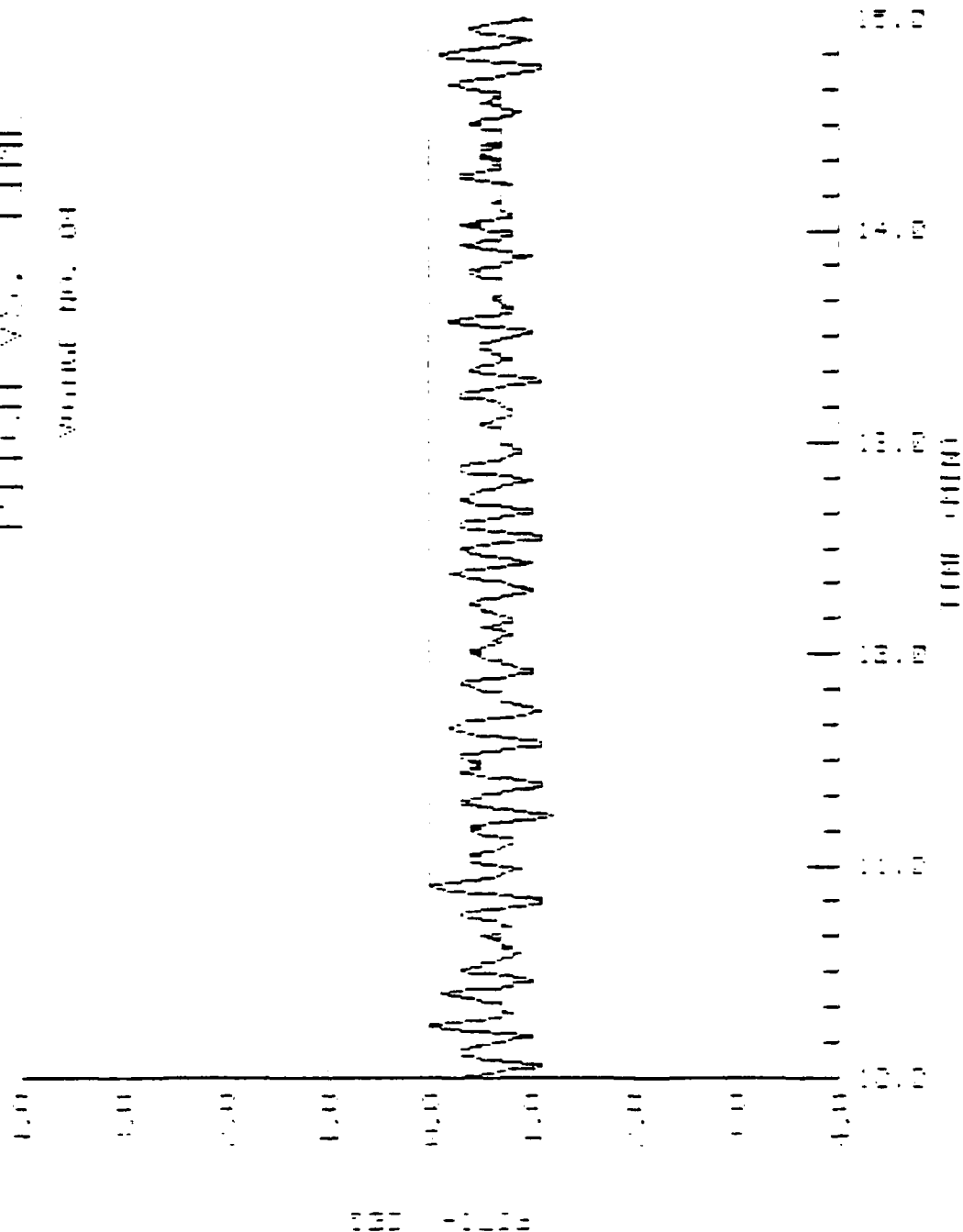




PLATE V. TIME

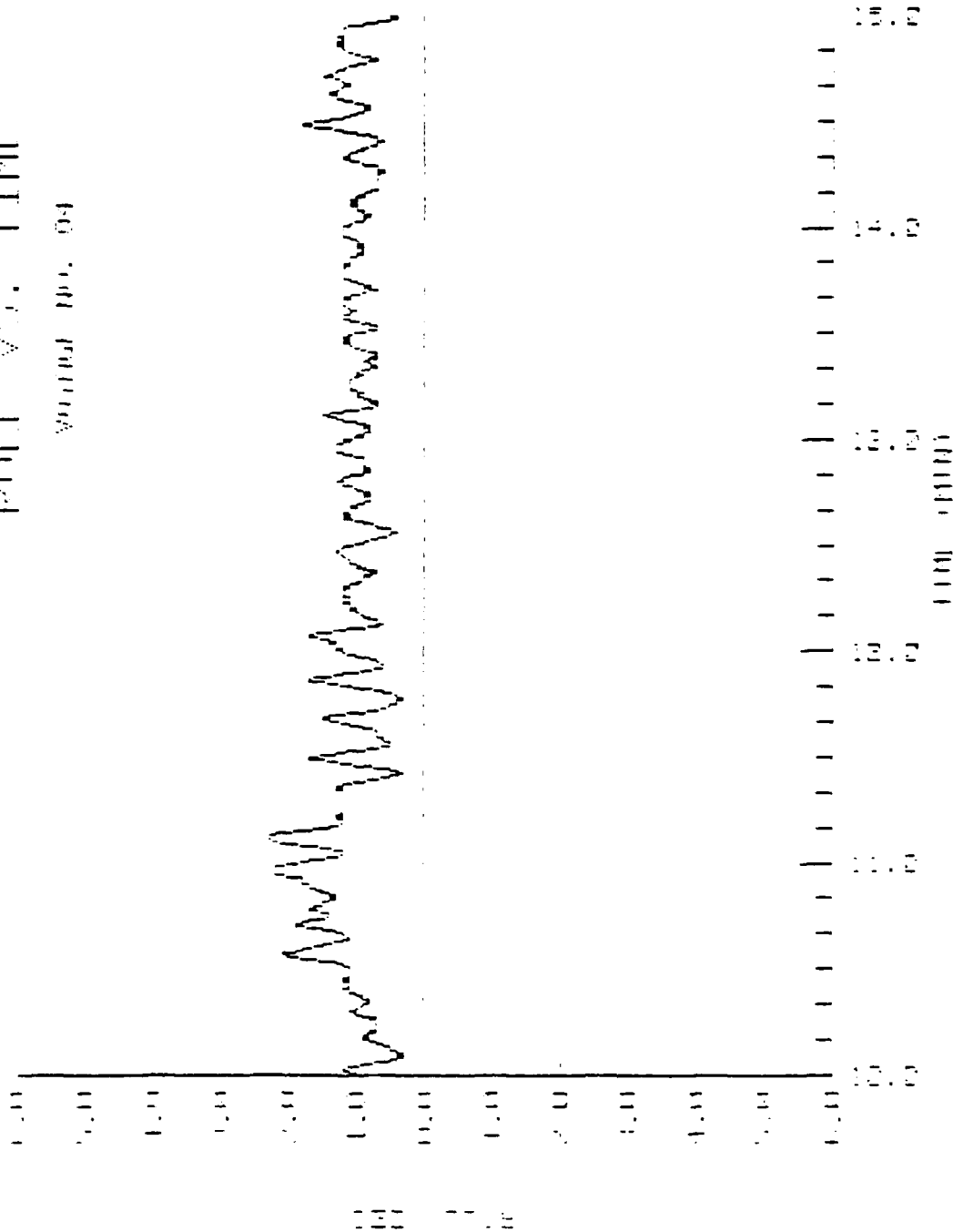
WOUND NO. 04





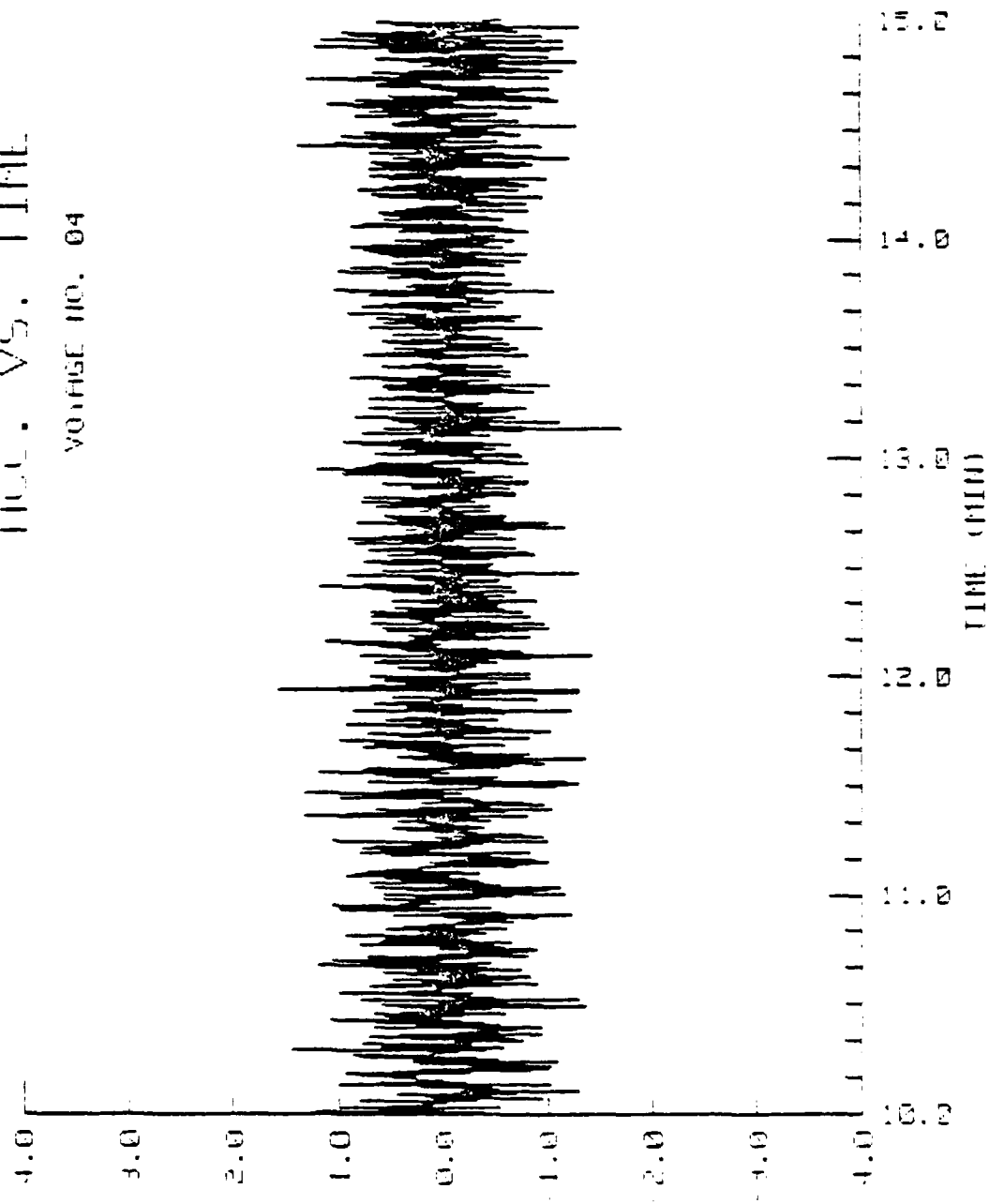
POLL VS. TIME

WIND NO. 04





# POC. VS. TIME VOISE NO. 04

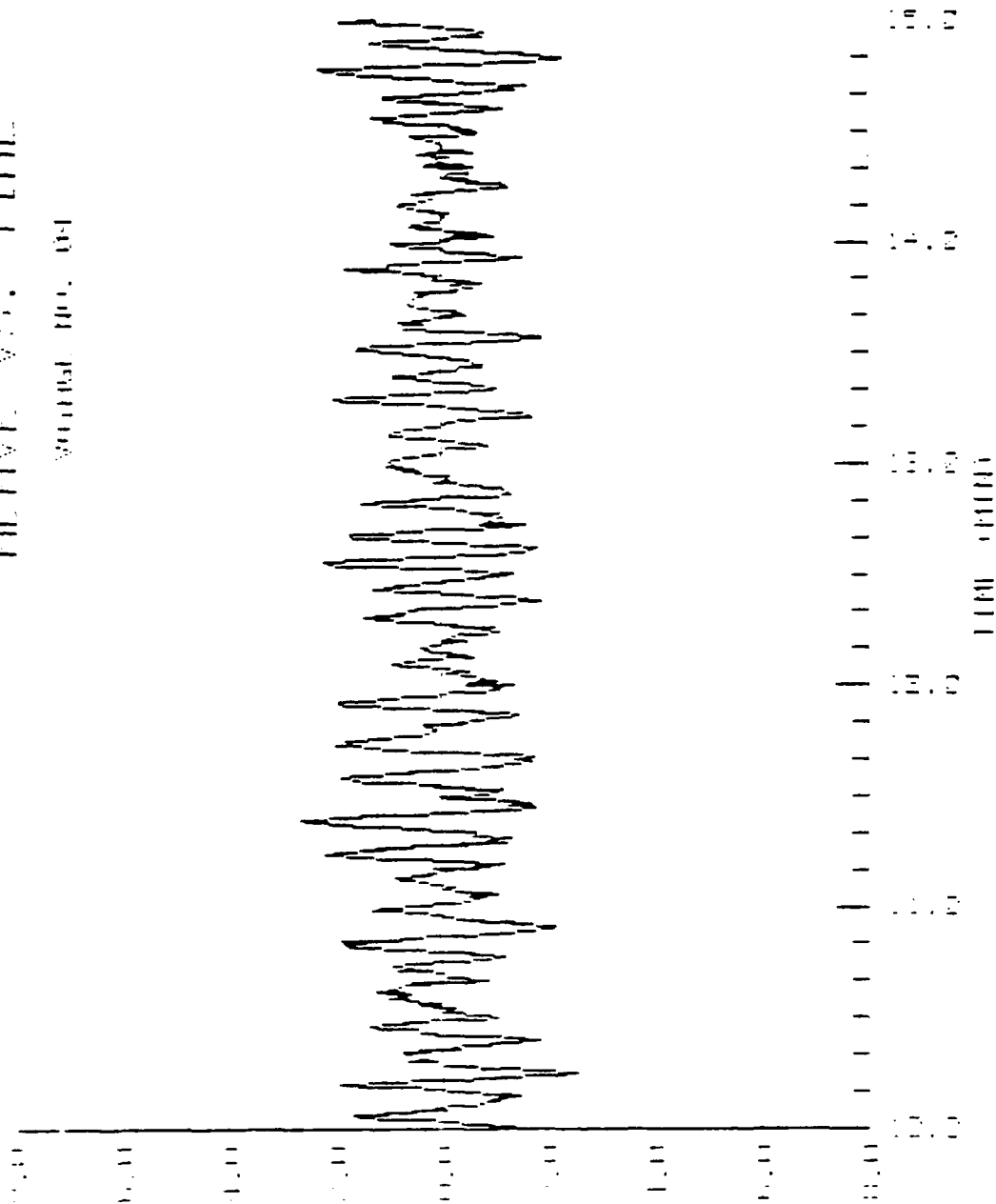


POC. VS. TIME



ELIOT, V. L. TIME

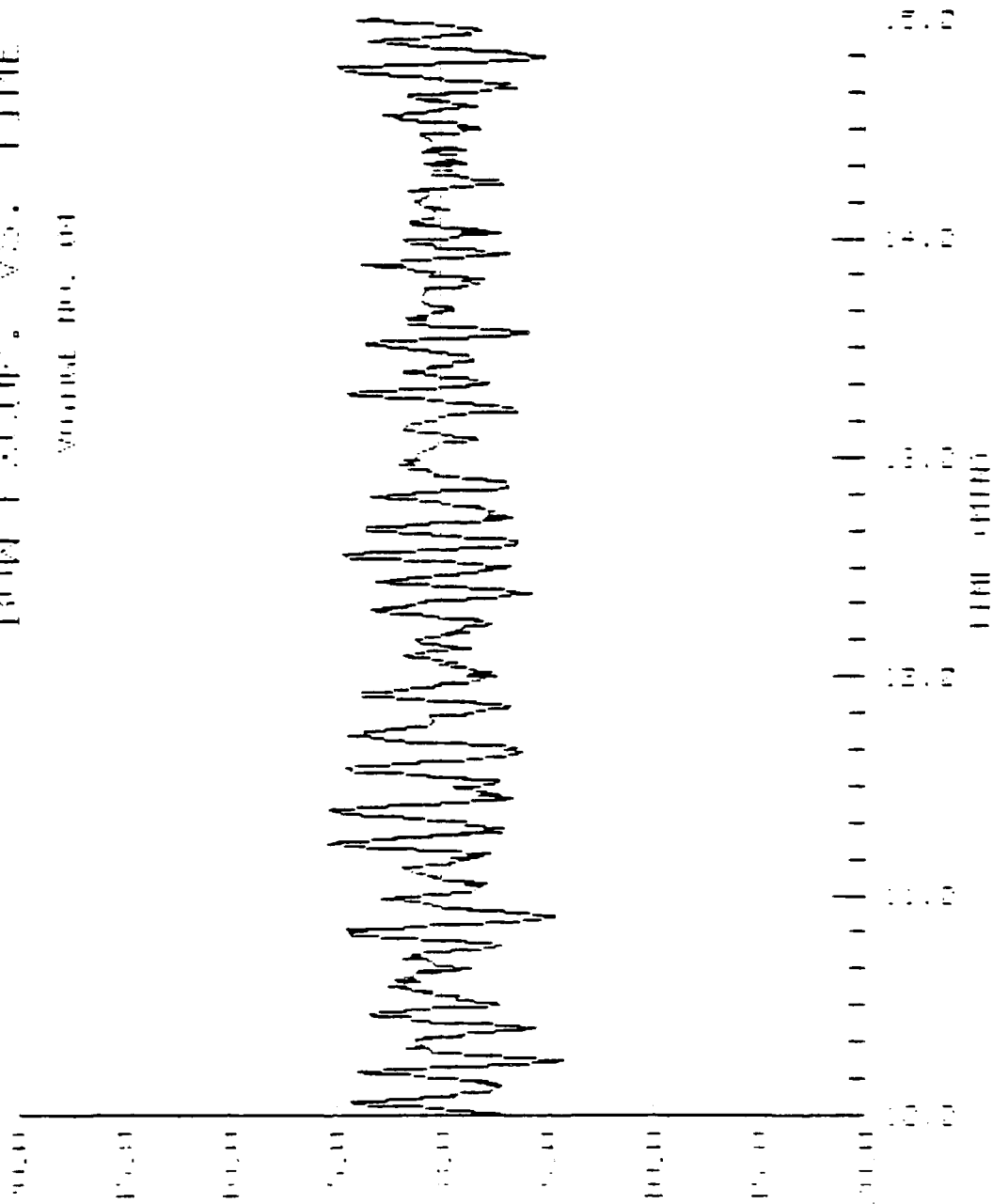
WIND, 100, 04





# BOOK 130.144. Vols. 1-11

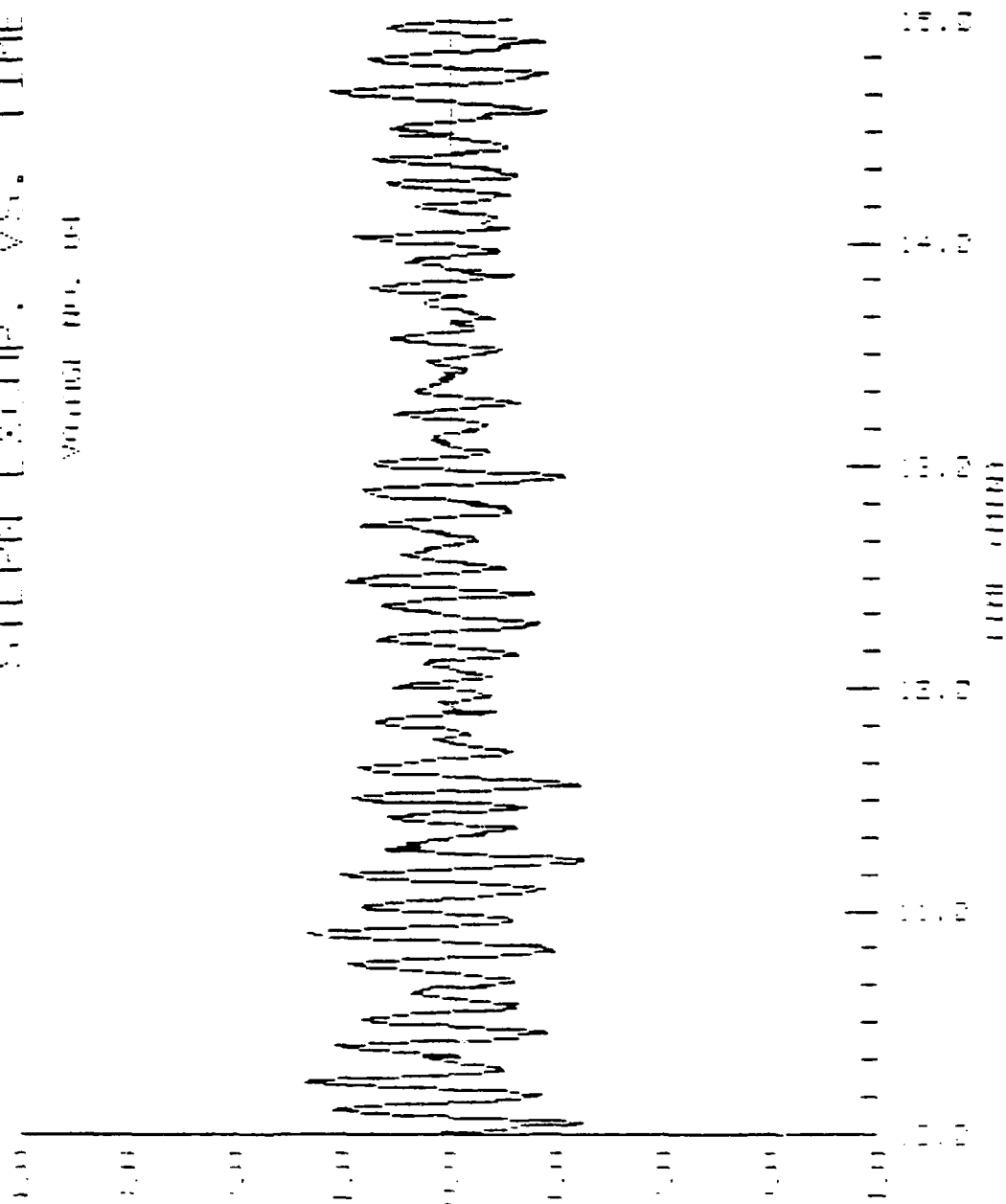
Volume 130.144





# SLEEP GROUP, VEG. TIME

WOMEN 100, 101



100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200



AD-A098 984

TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY,--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

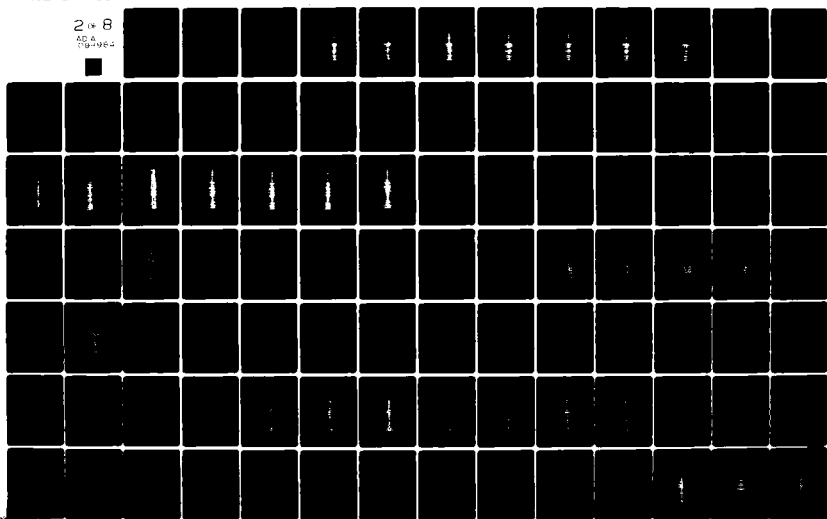
UNCLASSIFIED

TETRAT-TC-3925-APP-A(1)

NL

2 of 8

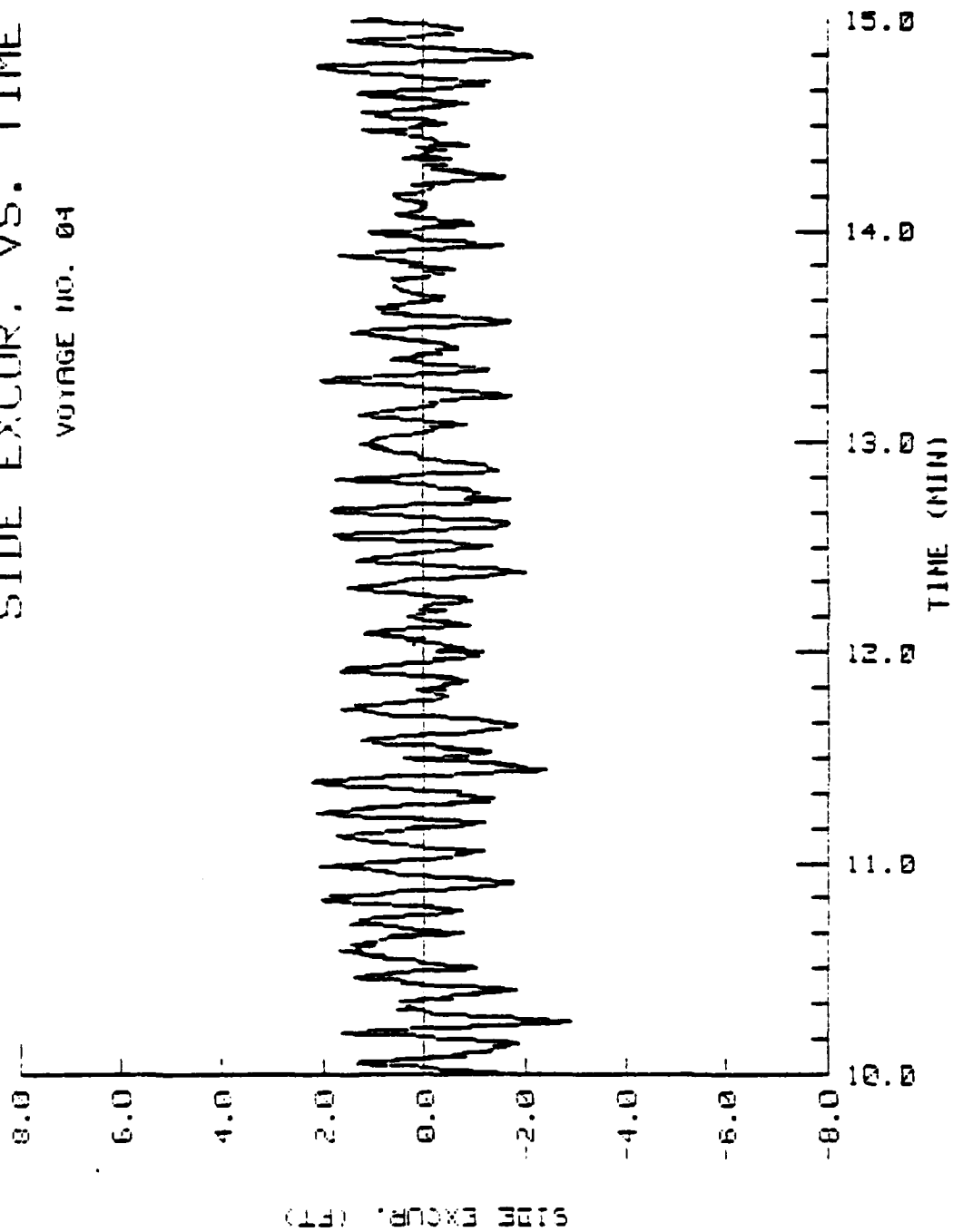
AD-A  
19-984





# SIDE EXCUR. VS. TIME

VOYAGE NO. 04





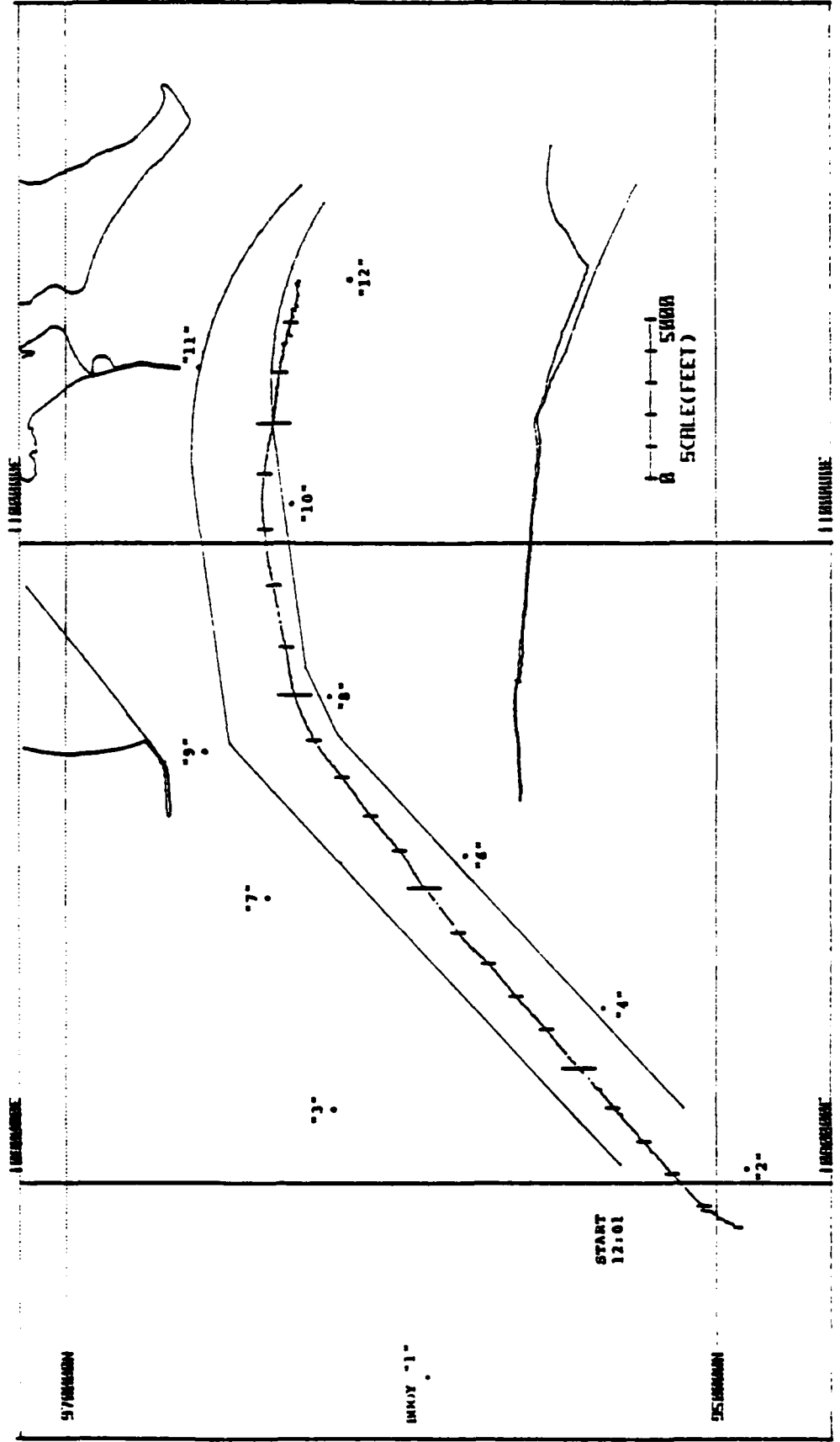
# STATISTICAL SUMMARY

VOYAGE NO. 05

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.0	1.5	.7	.7
ROLL (DEG)	1.5	3.8	1.6	1.8
ACC (FT/SEC/SEC)	-1.1	1.7	.7	.8
HEAVE (FT)	-1.0	4.7	2.0	2.2
BOW EXCUR. (FT)	-1.1	12.6	4.6	5.4
STERN EXCUR. (FT)	.0	4.9	2.0	2.3
SIDE EXCUR (FT)	-1.0	5.7	2.3	2.6



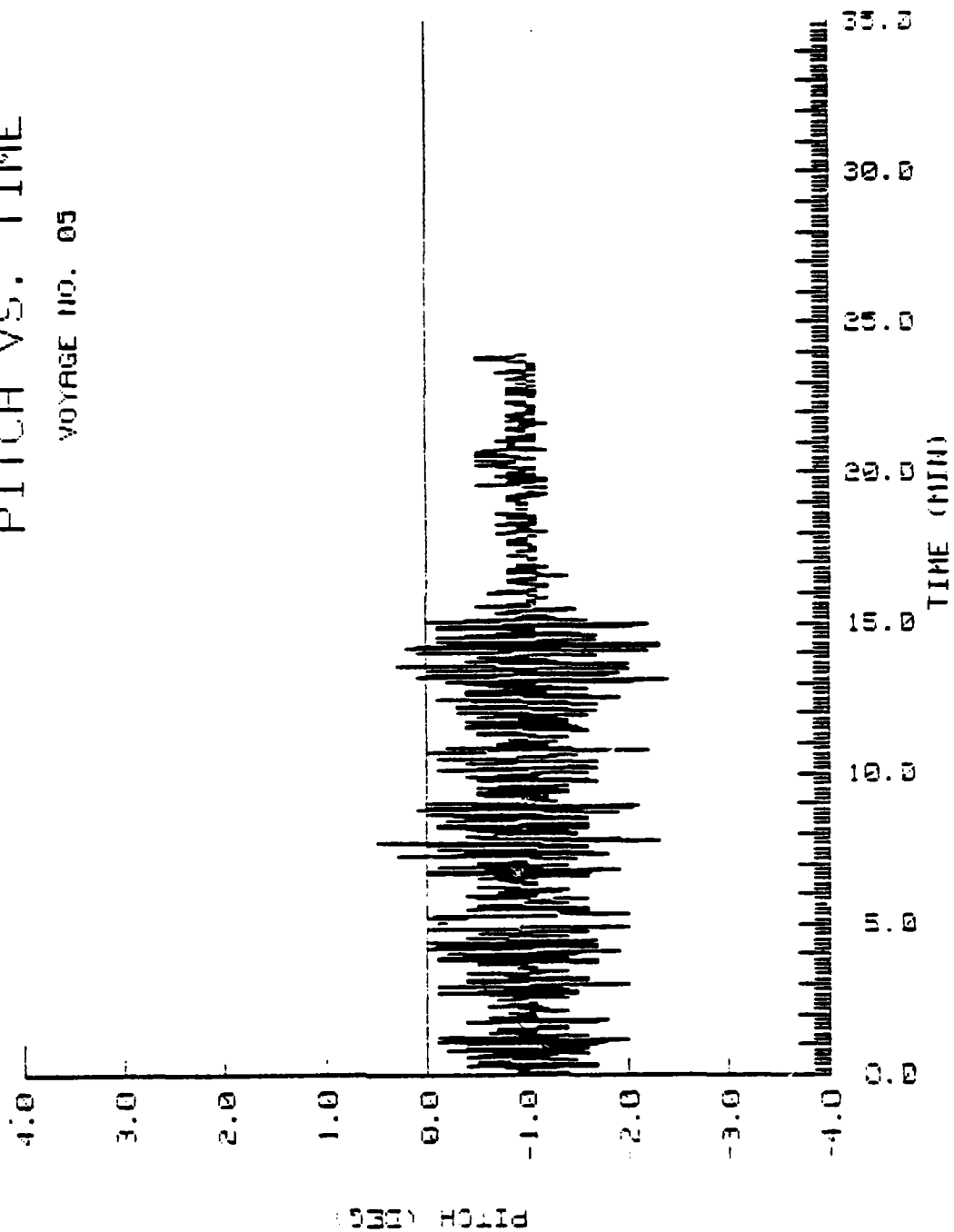
# VUYHGE NO. 05 SHIP TRACK SCINE 1: 30000





# PITCH VS. TIME

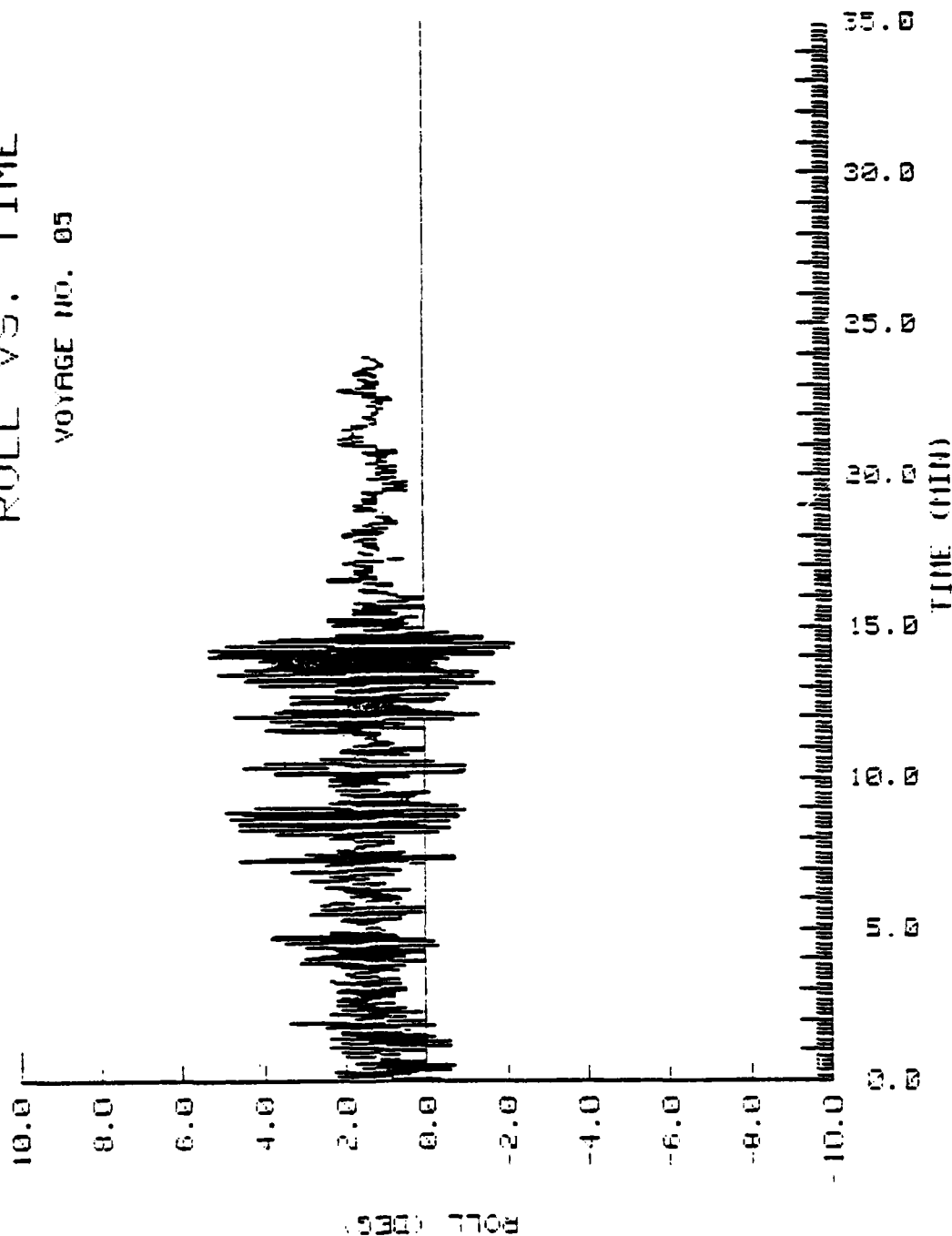
VOYAGE NO. 05





# ROLL VS. TIME

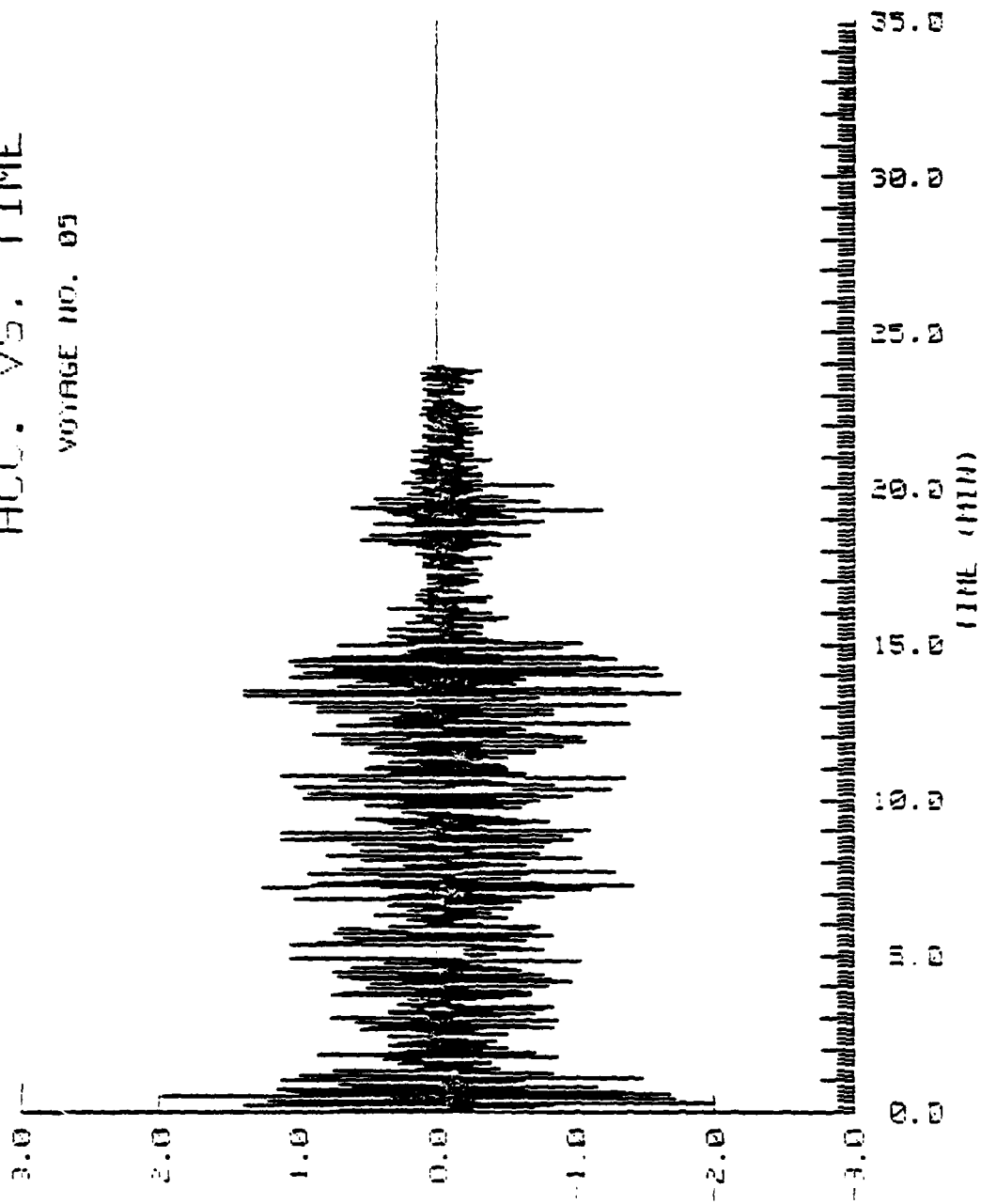
VOYAGE NO. 05





ACC. VS. TIME

VOLTAJE NO. 05

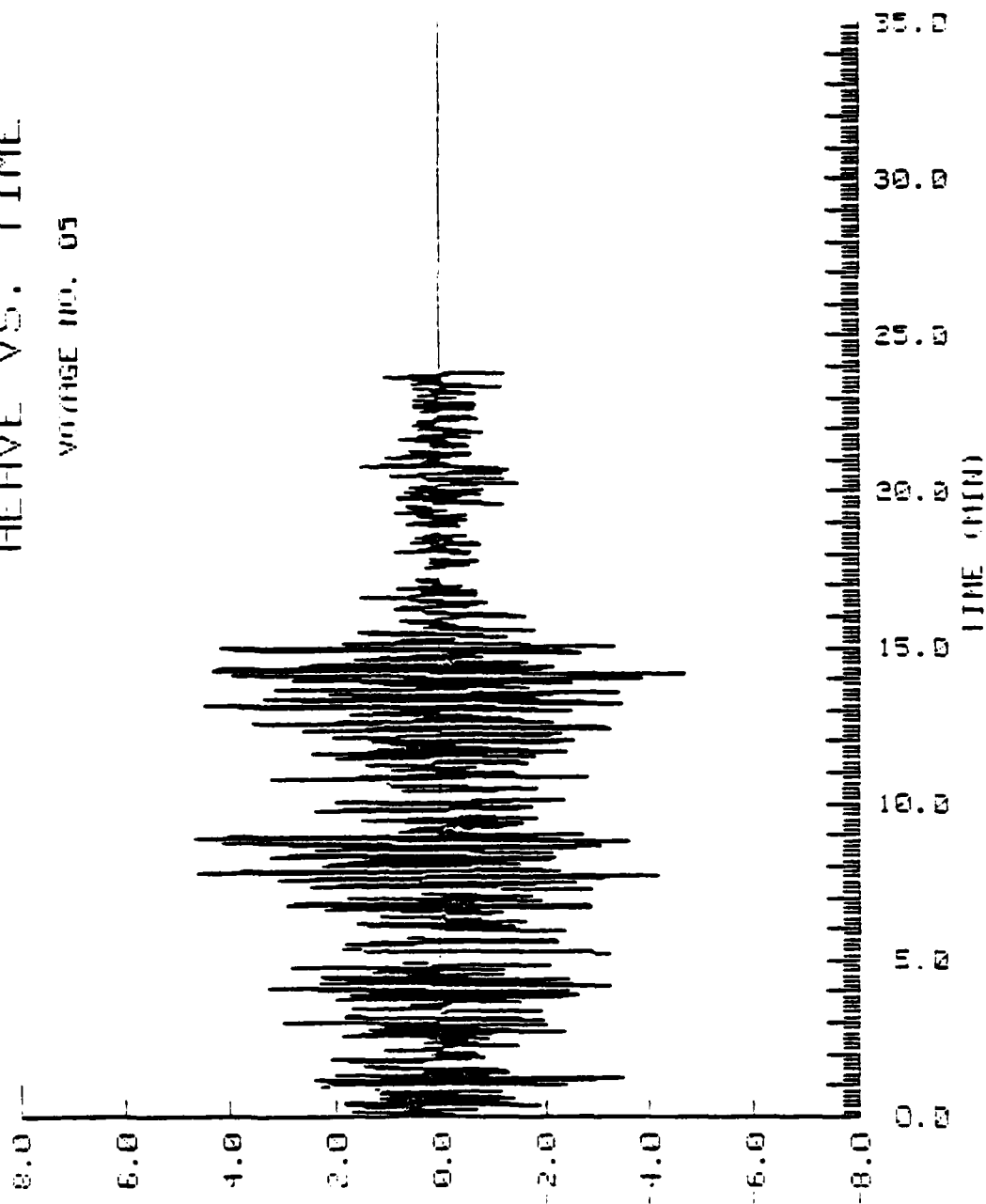


1000 1000 1000 1000



# HEAVE VS. TIME

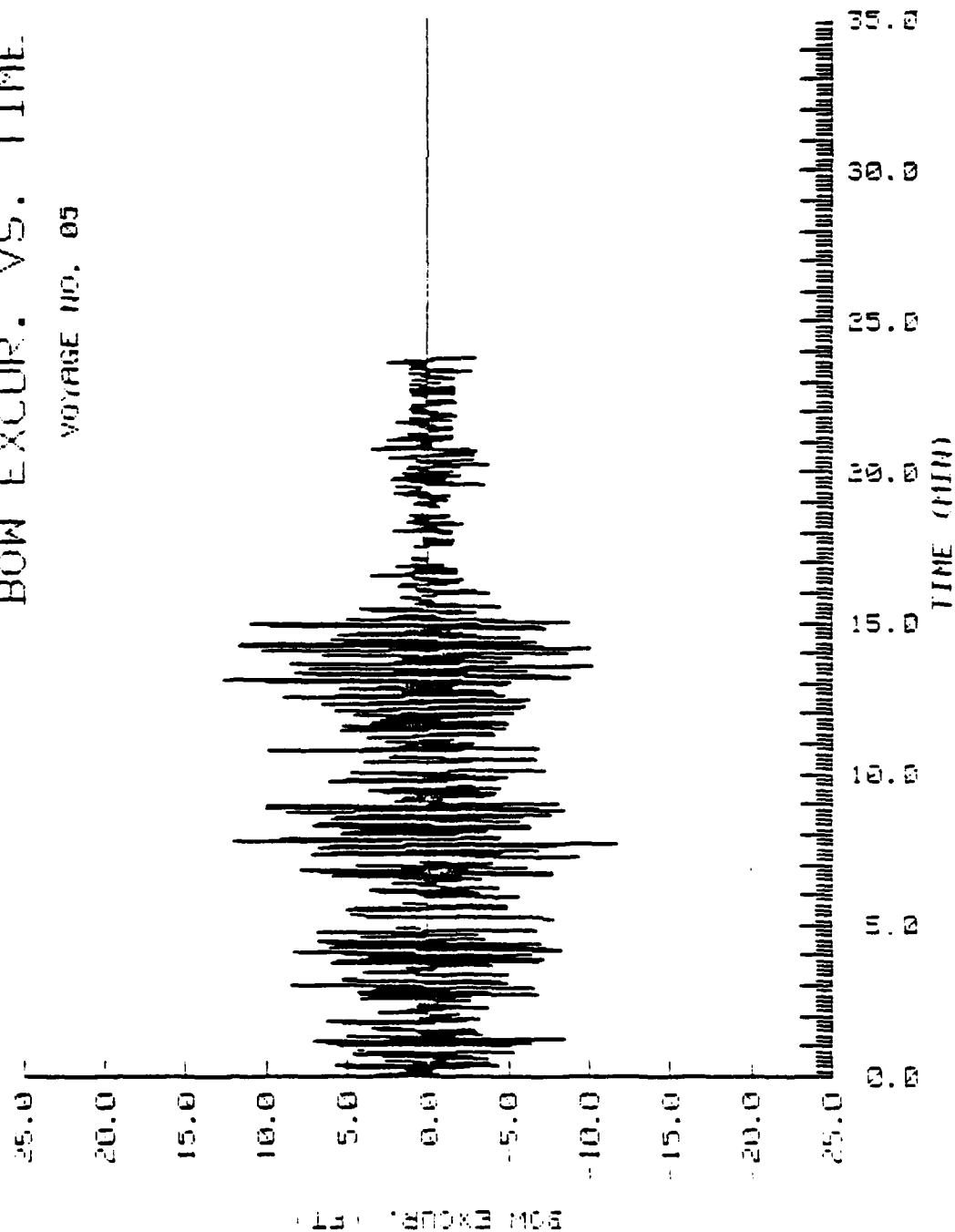
VOLTAJE NO. 05





# BOW EXCUR. VS. TIME

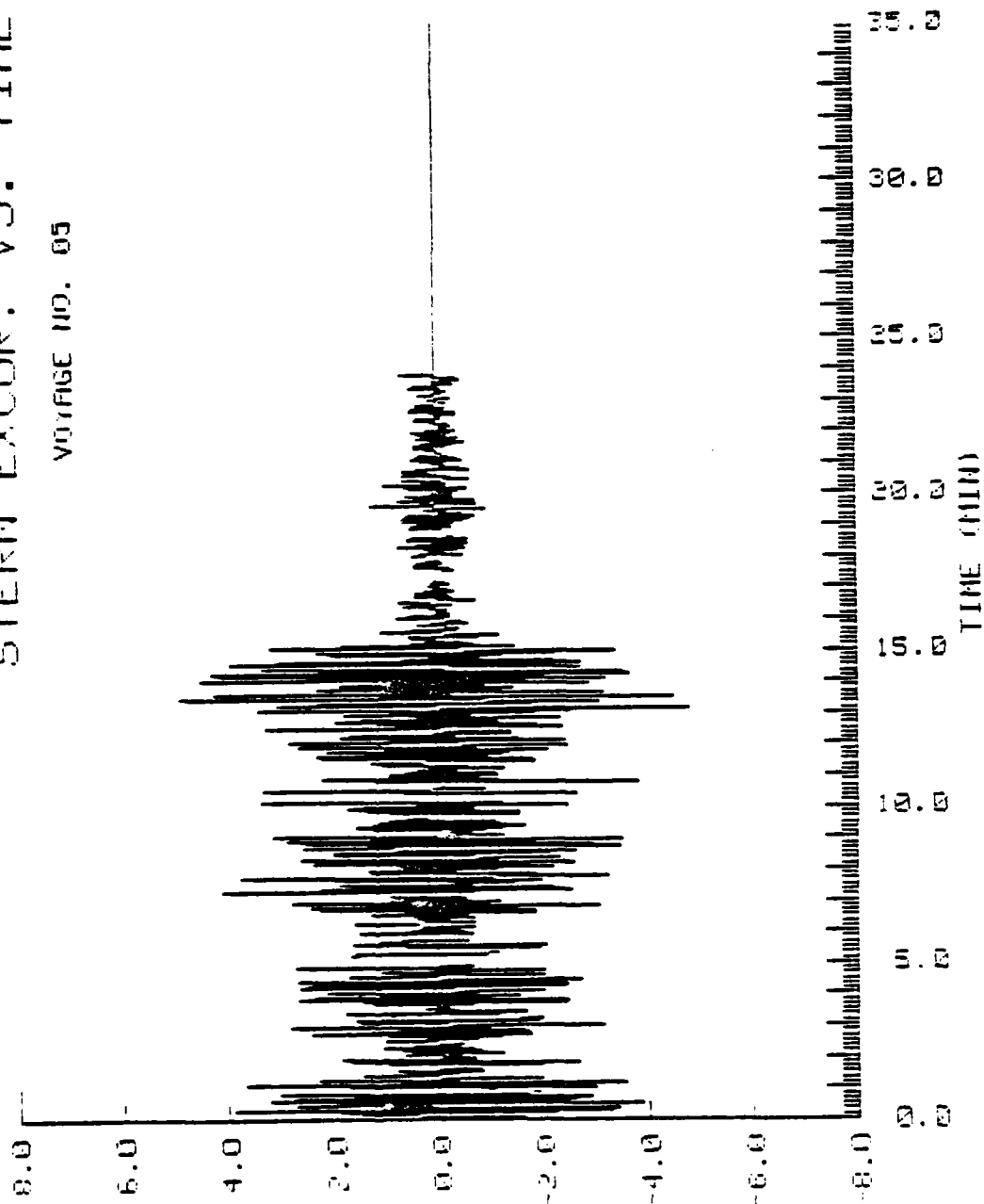
VOYAGE NO. 05





# STERN EXCUR. VS. TIME

VOYAGE NO. 05

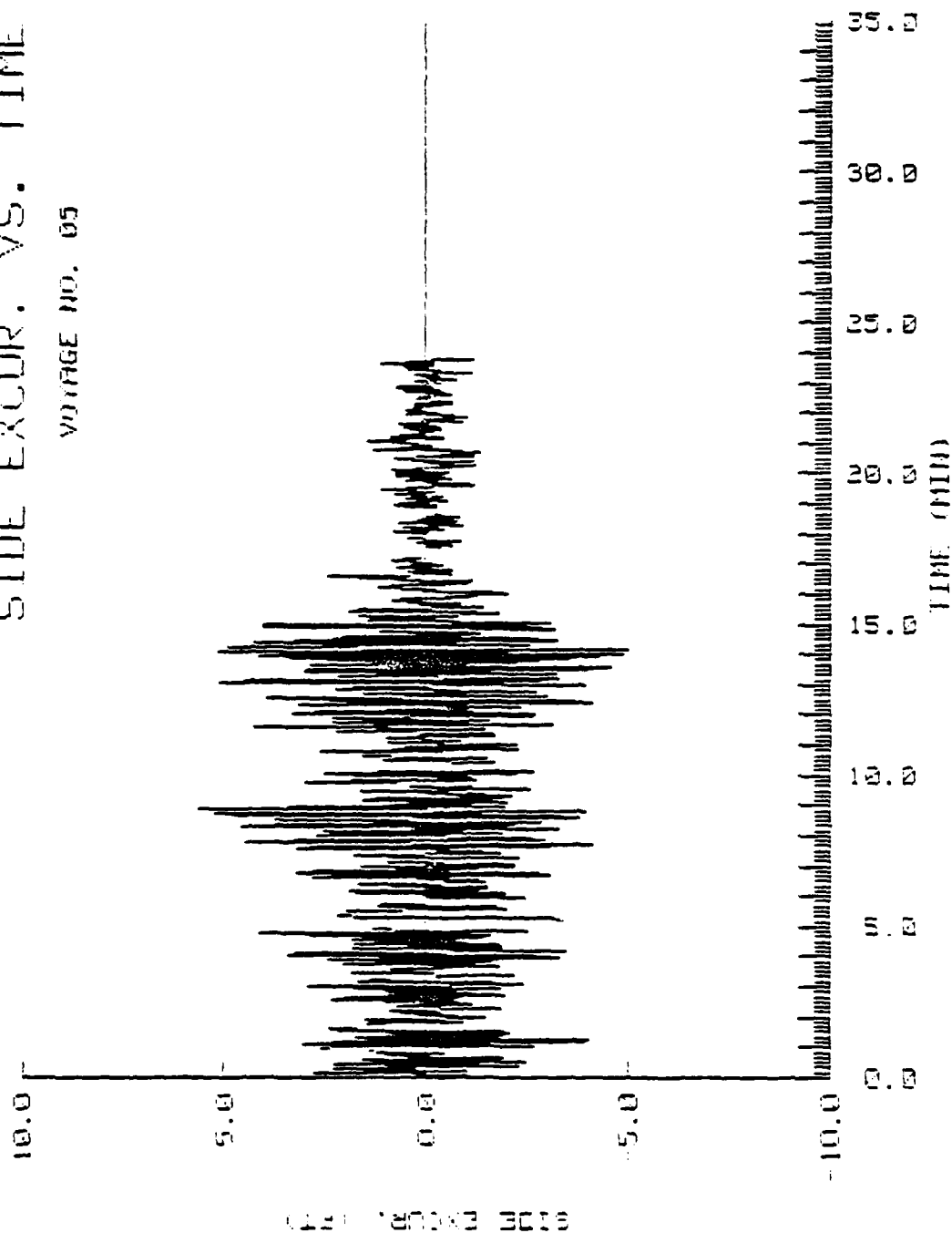


STERN EXCUR. (ST)



SIDE EXCUR. VS. TIME

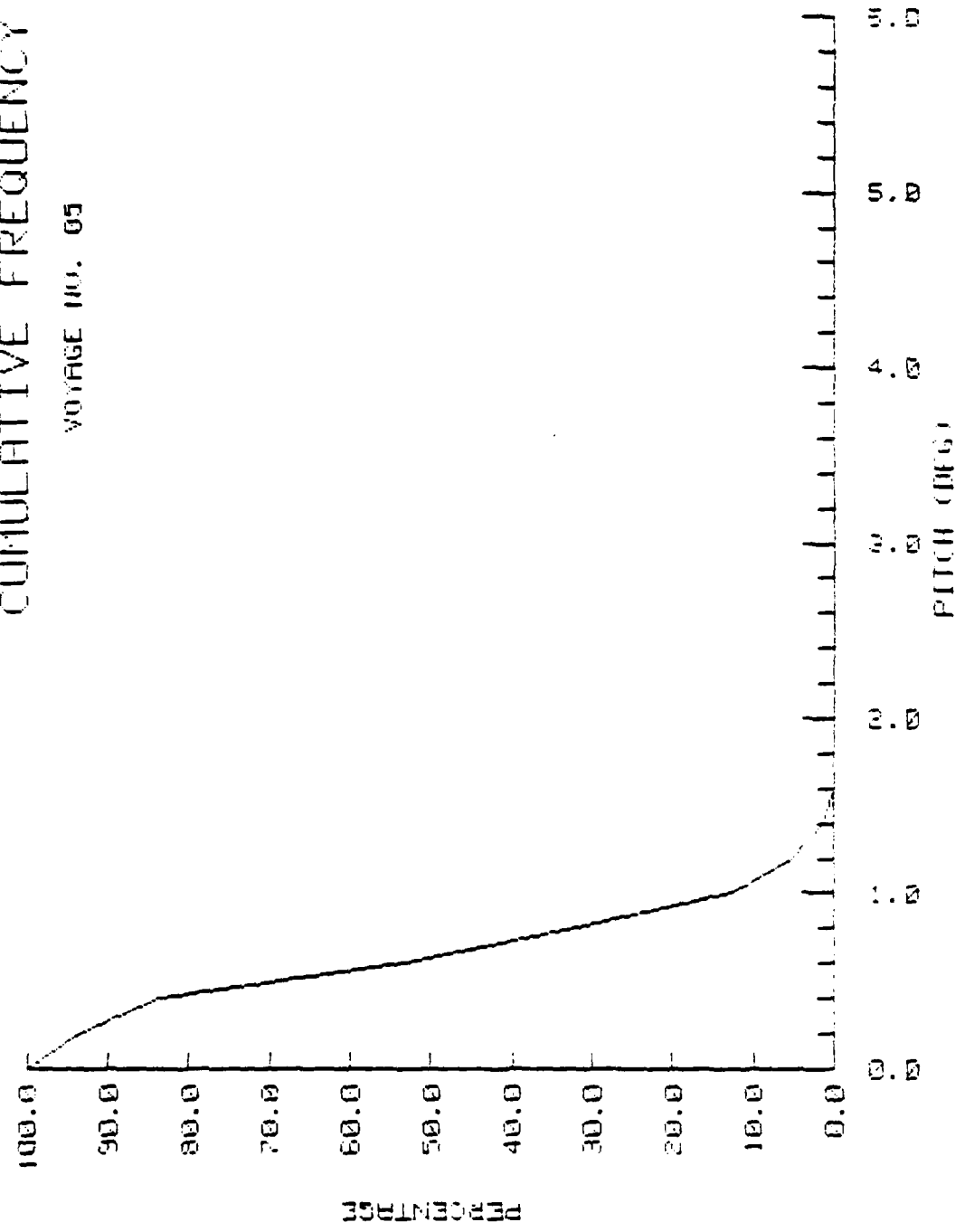
VOLTAGE NO. 05





# CUMULATIVE FREQUENCY

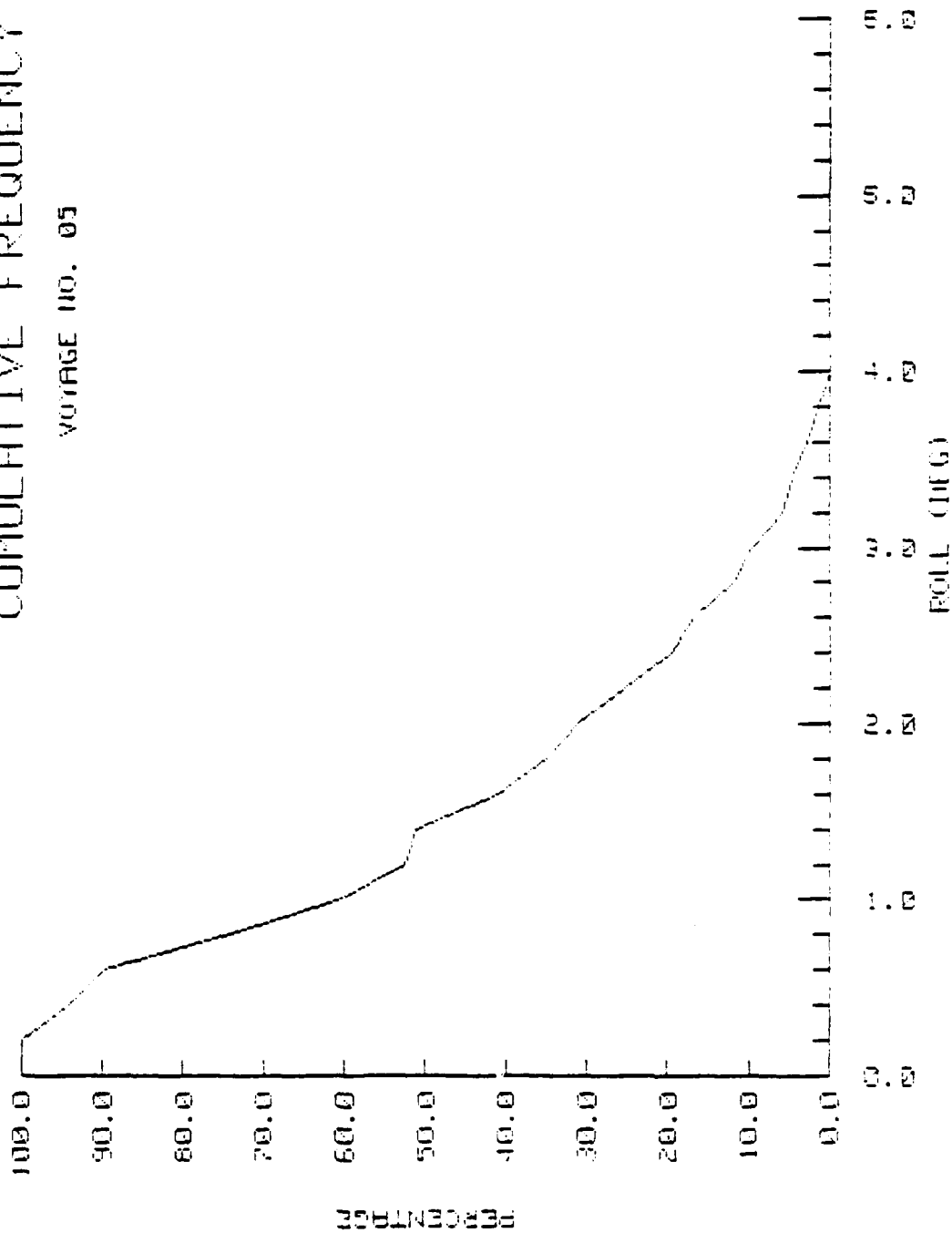
VOTAGE NO. 05





# CUMULATIVE FREQUENCY

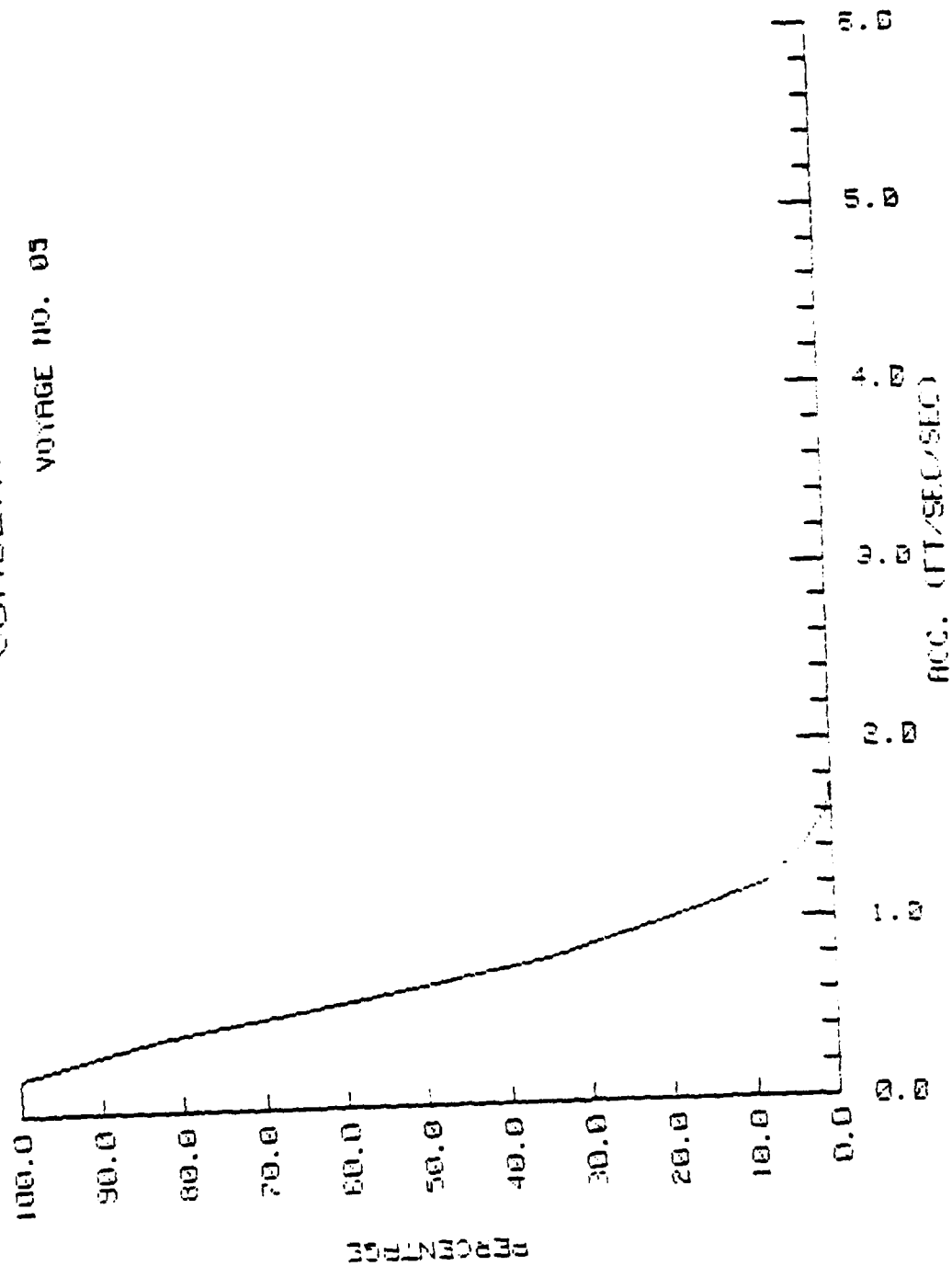
VOYAGE NO. 05





# CUMULATIVE FREQUENCY

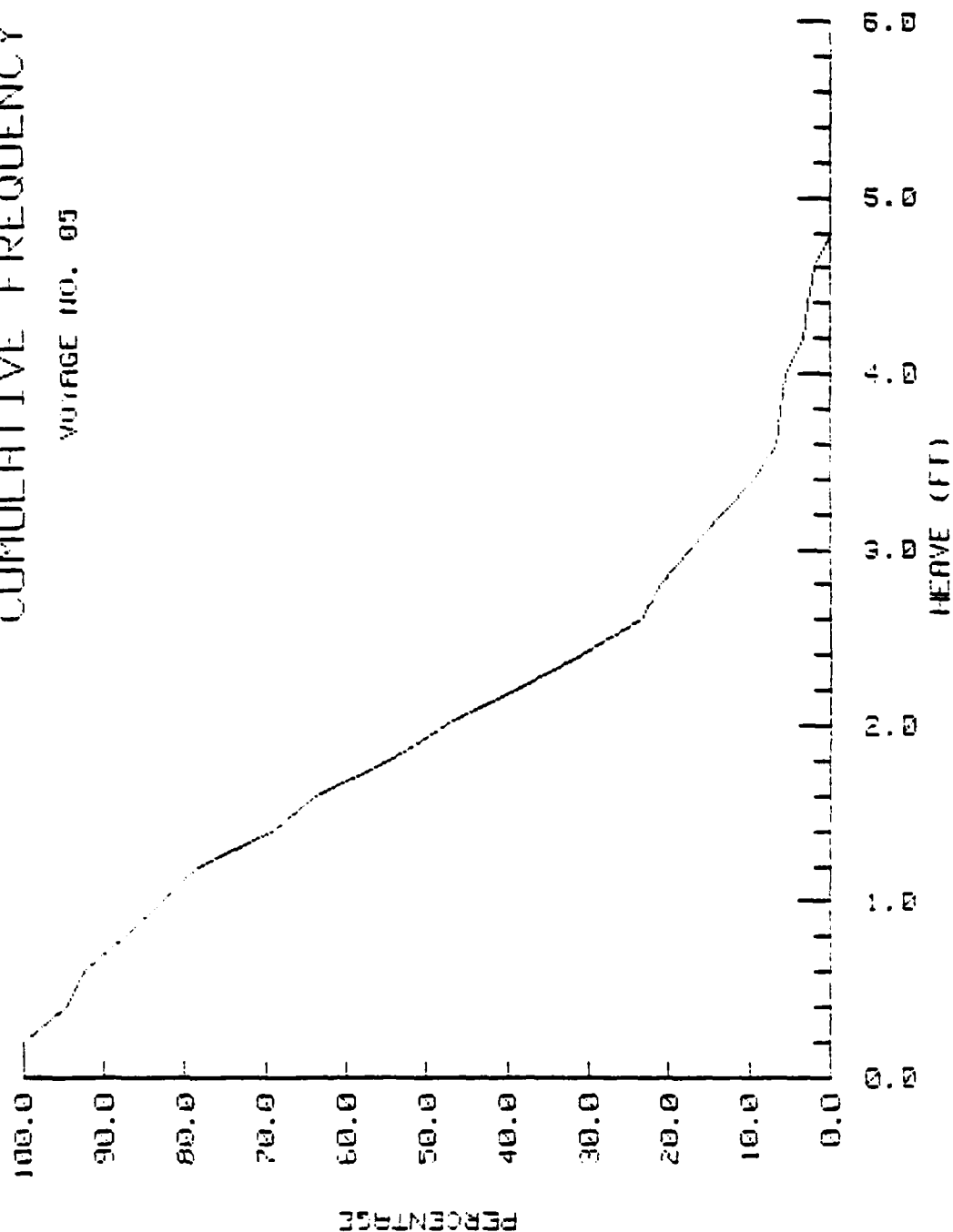
VOTAGE NO. 05





# CUMULATIVE FREQUENCY

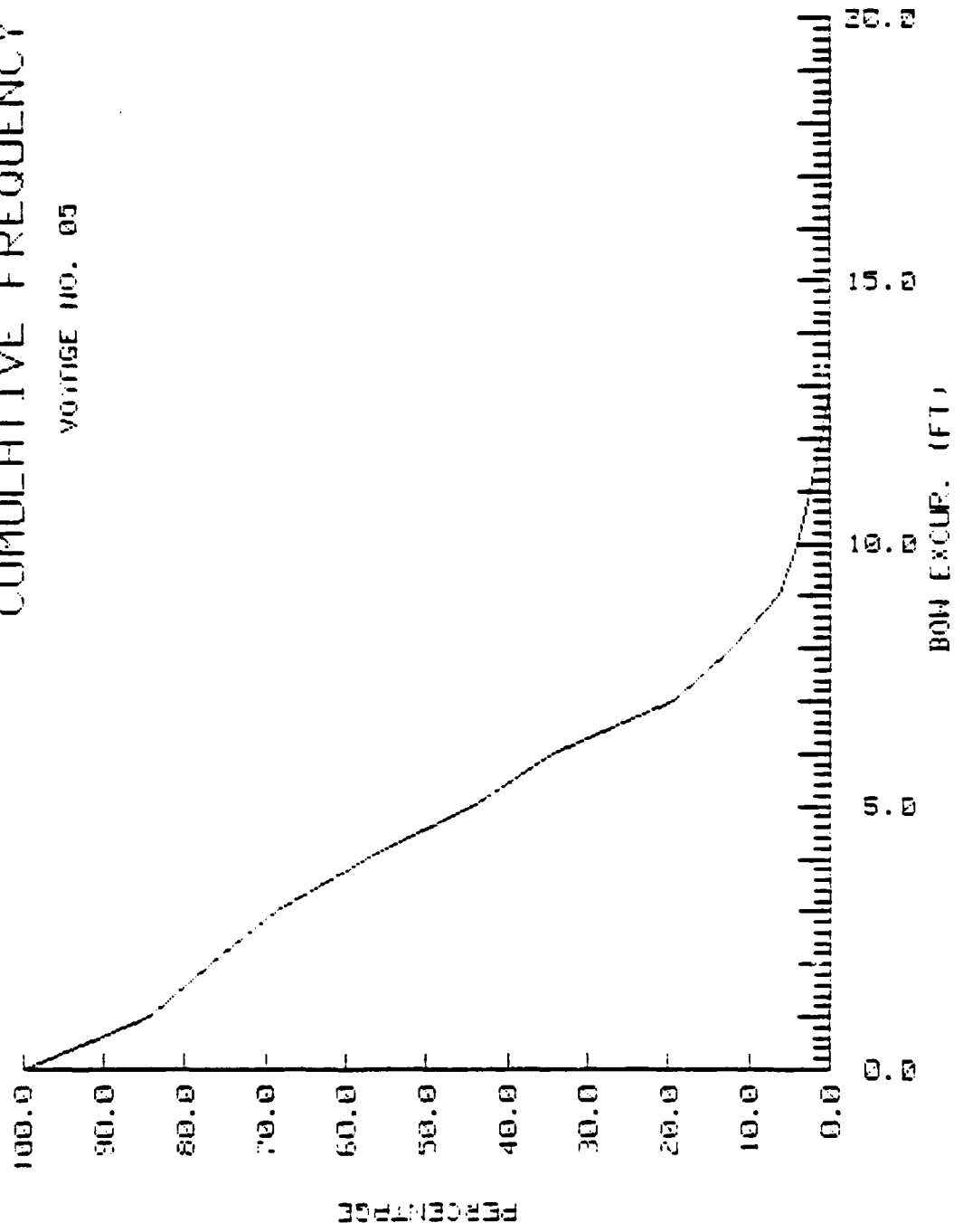
VOLTAJE NO. 05





# CUMULATIVE FREQUENCY

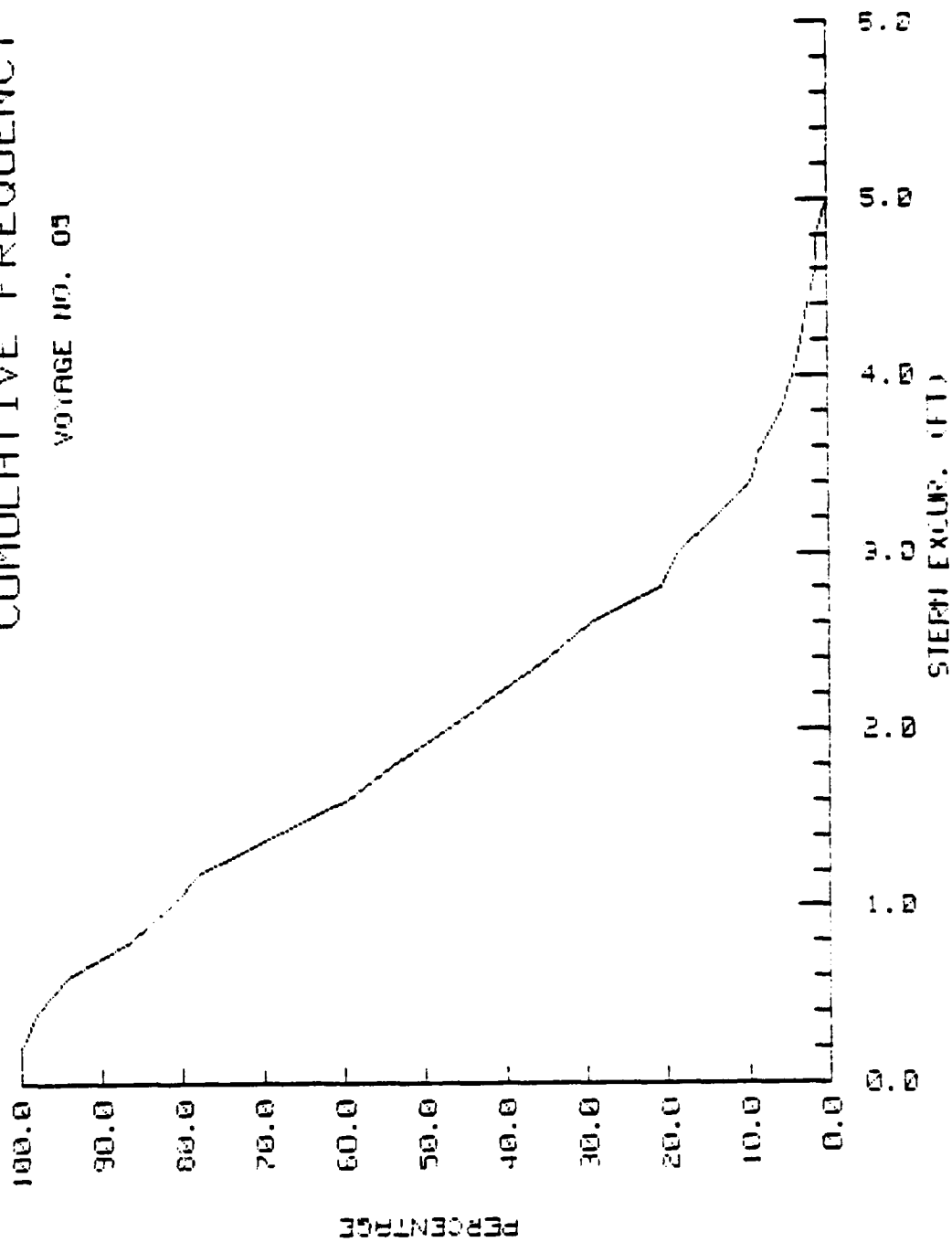
VOTAGE NO. 05





# CUMULATIVE FREQUENCY

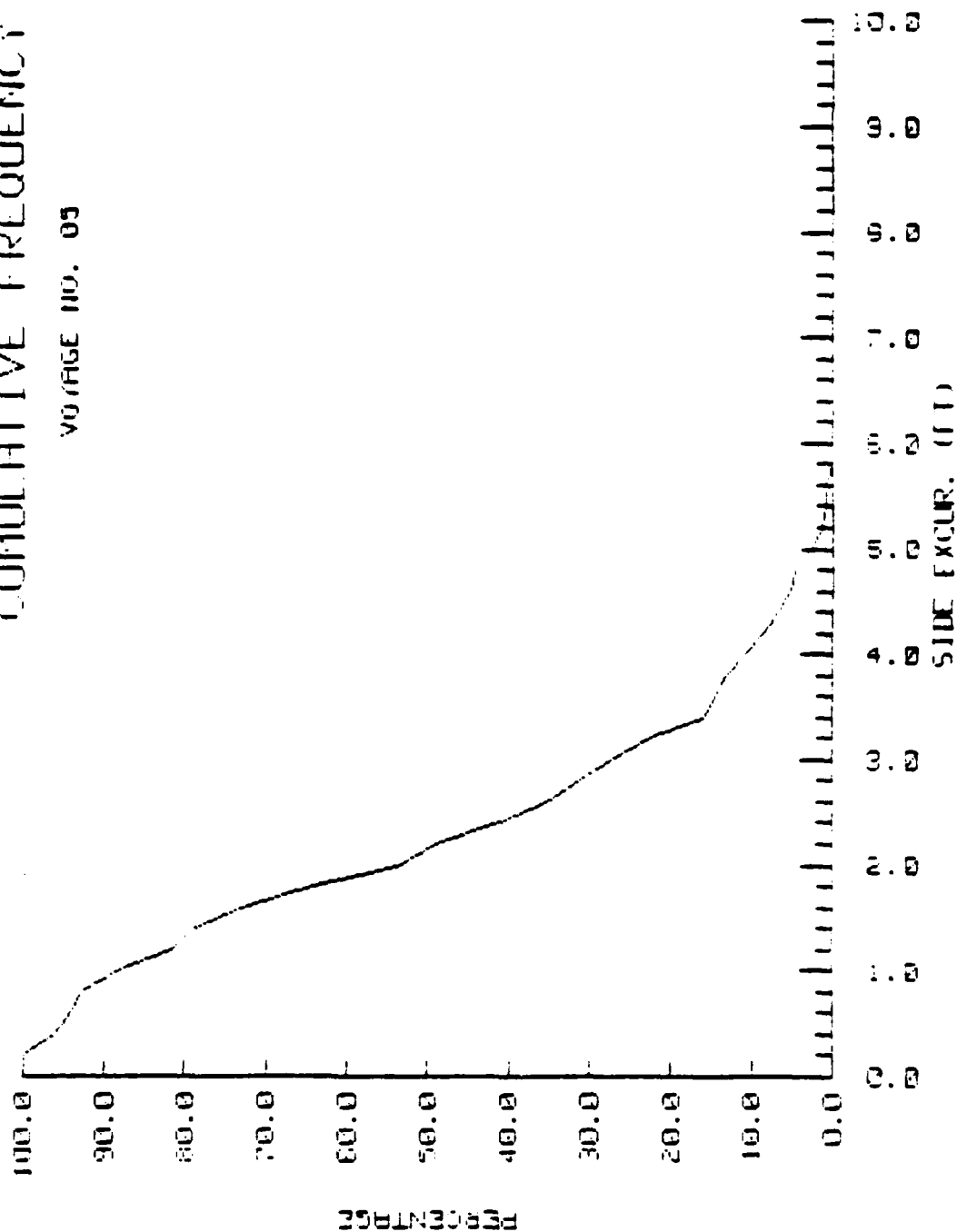
VOTAGE NO. 03





# CUMULATIVE FREQUENCY

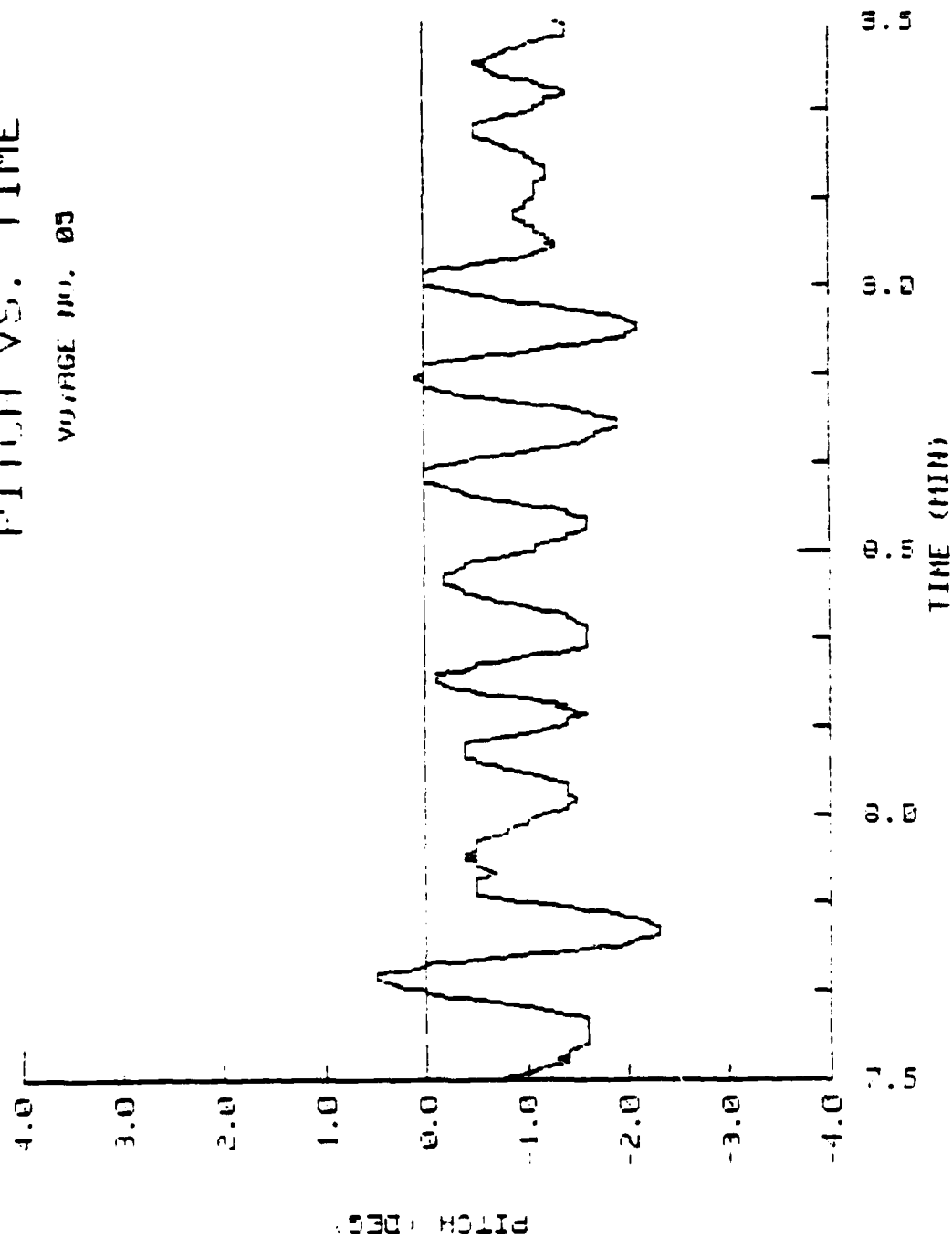
VOLAGE 110. 05





# PITCH VS. TIME

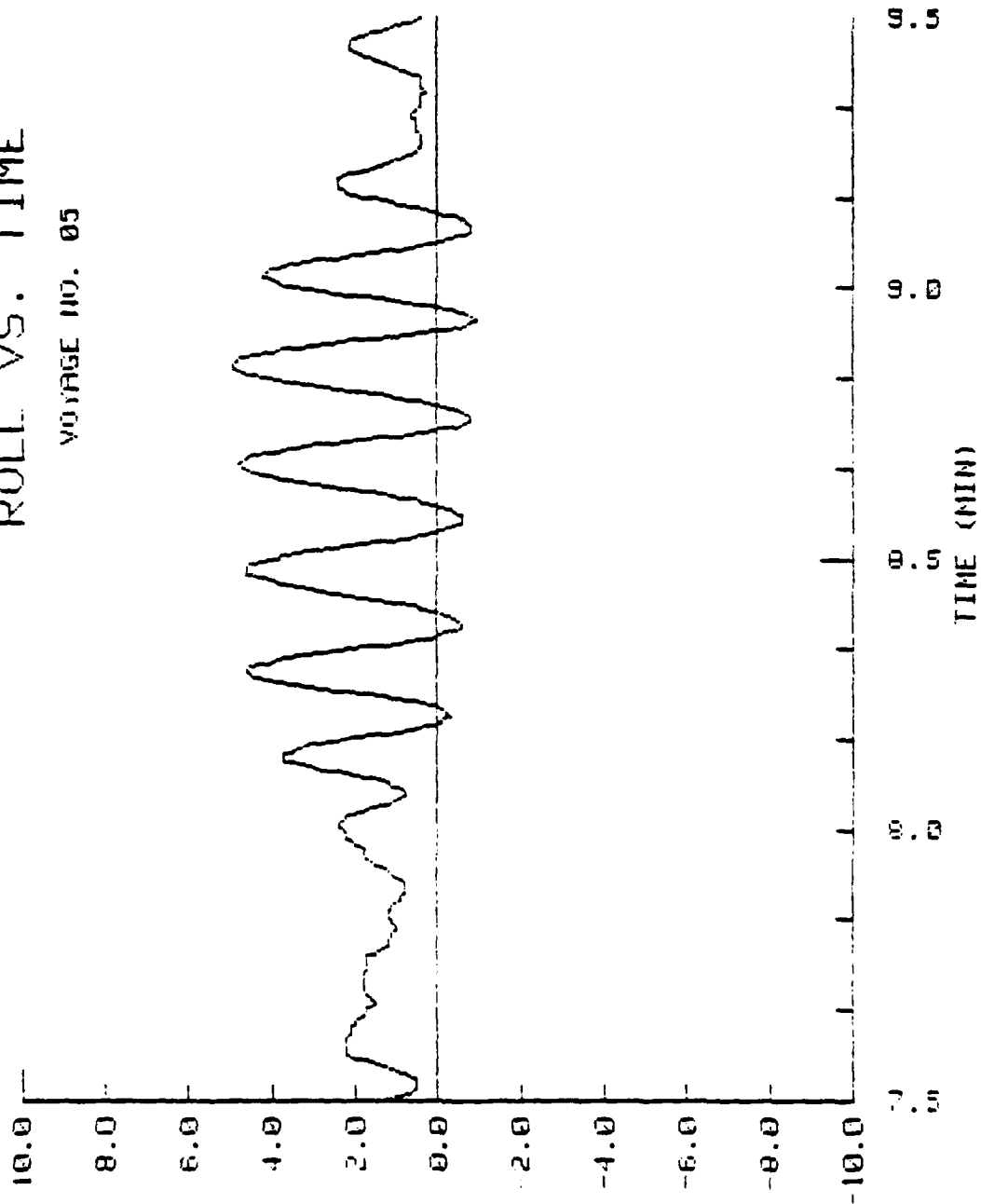
WAVE NO. 03





# ROLL VS. TIME

VOLTAGE NO. 05

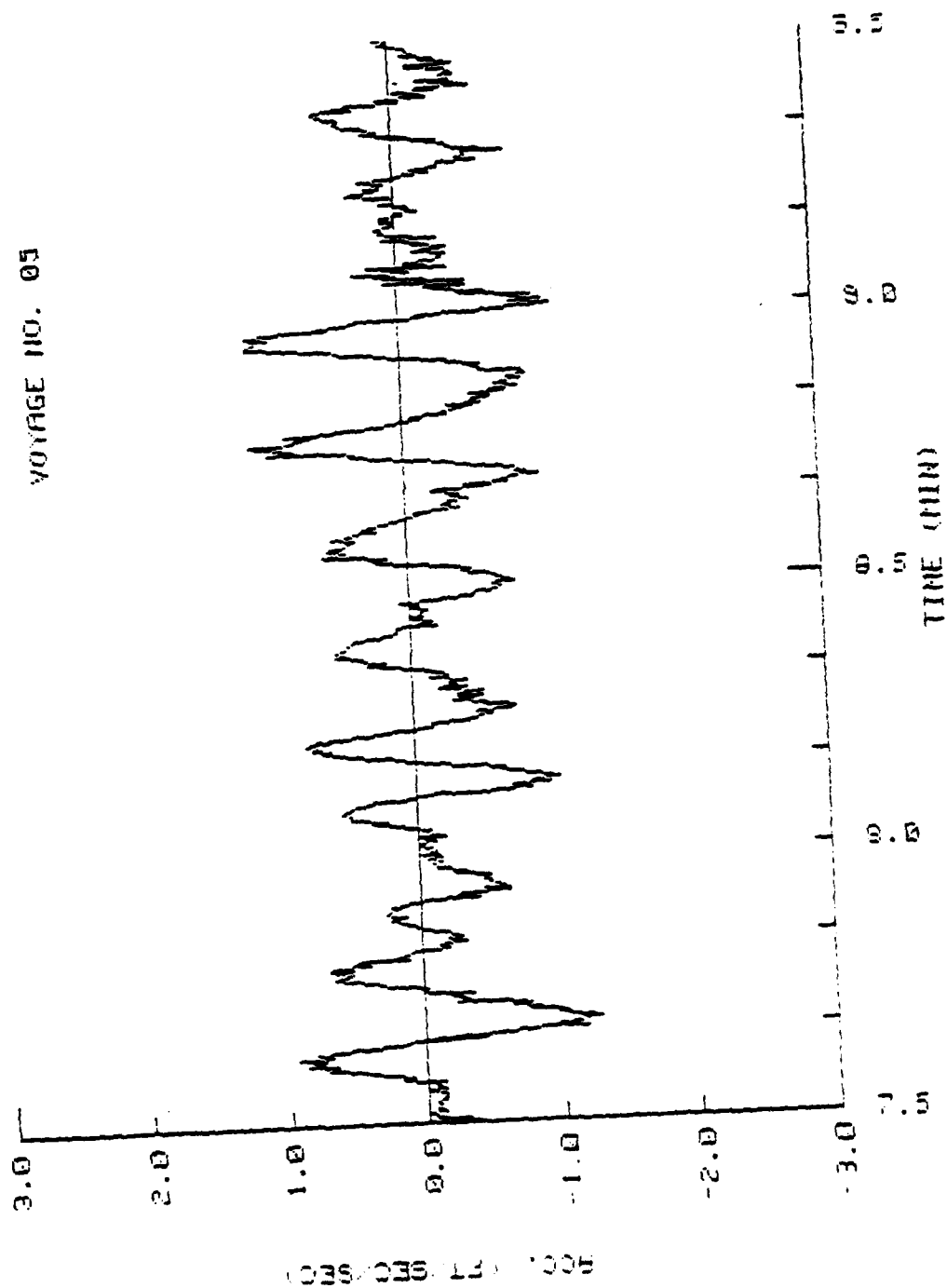


1930 1700



# ACC. VS. TIME

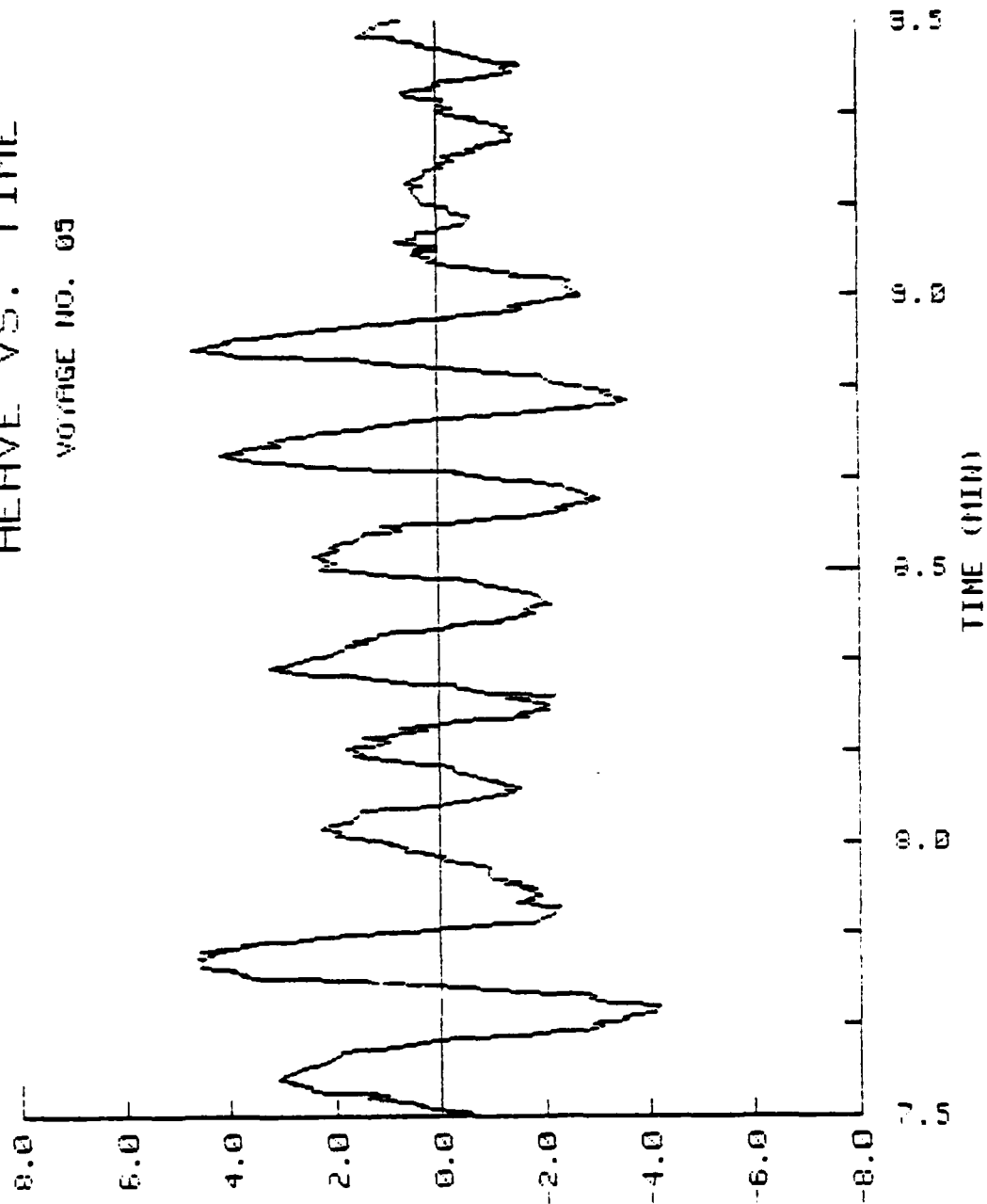
VOYAGE NO. 05





# HEAVE VS. TIME

VOLTAJE NO. 05

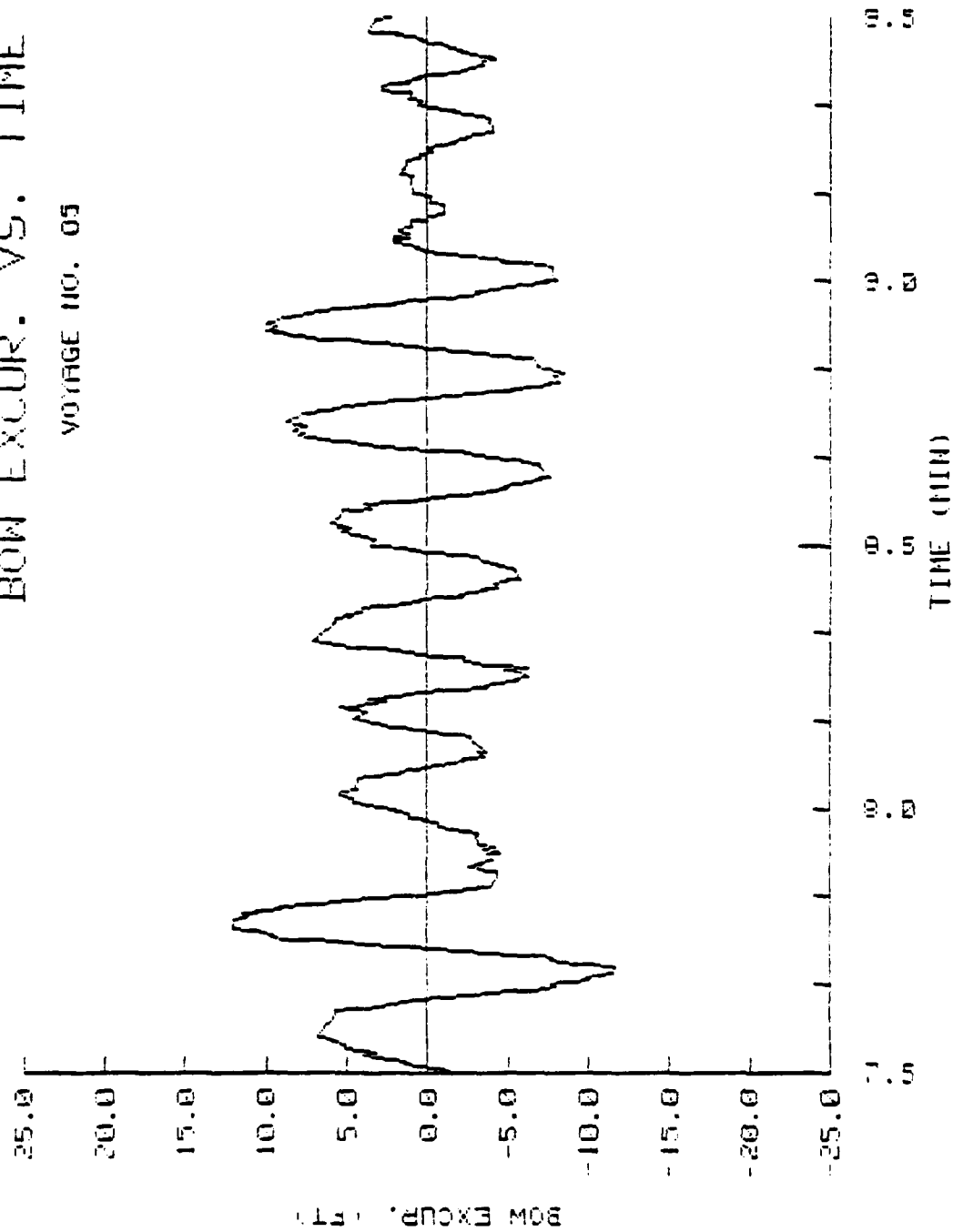


HEAVE (CM)



# BOW EXCUR. VS. TIME

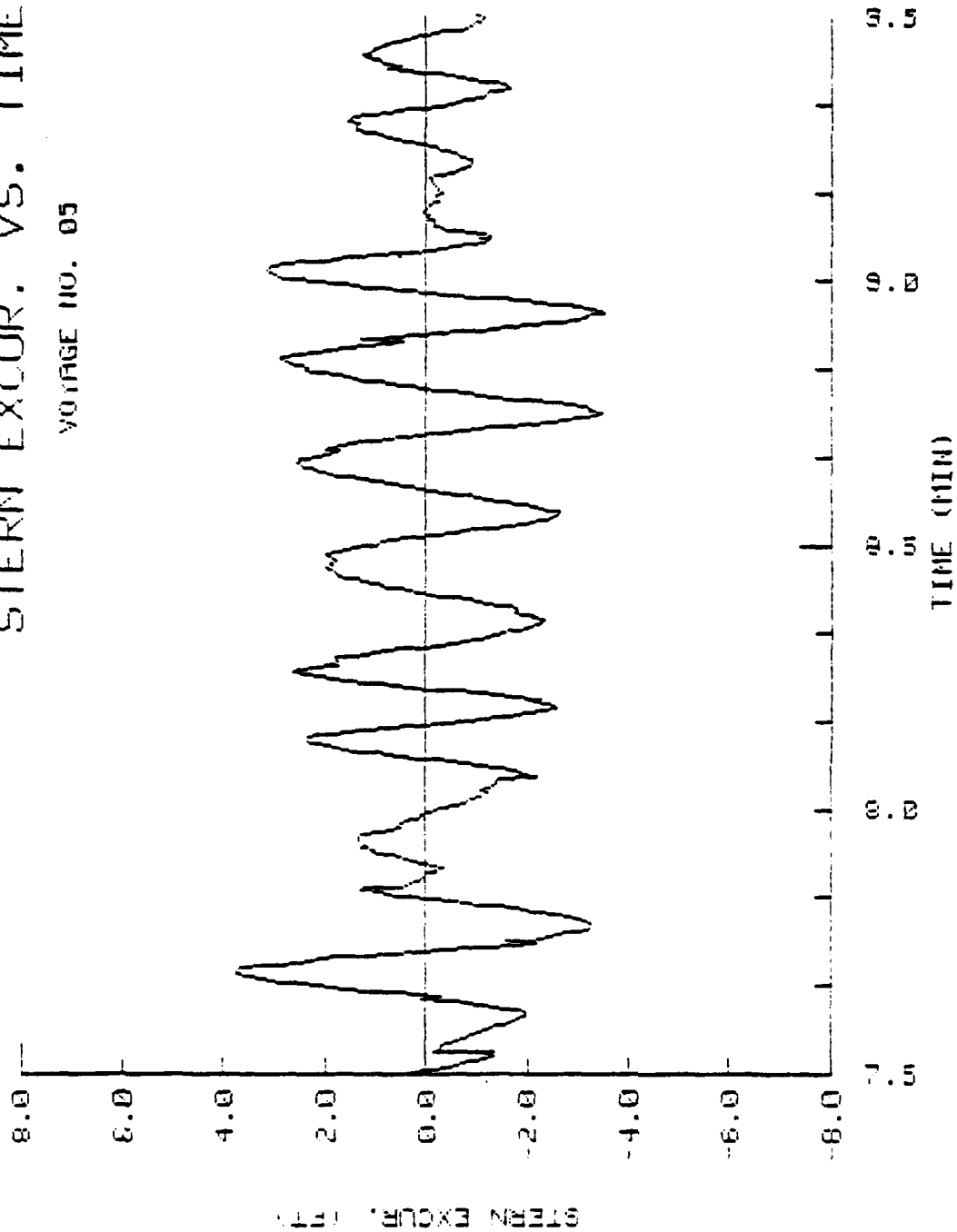
VOLTAGE NO. 05





# STERN EXCUR. VS. TIME

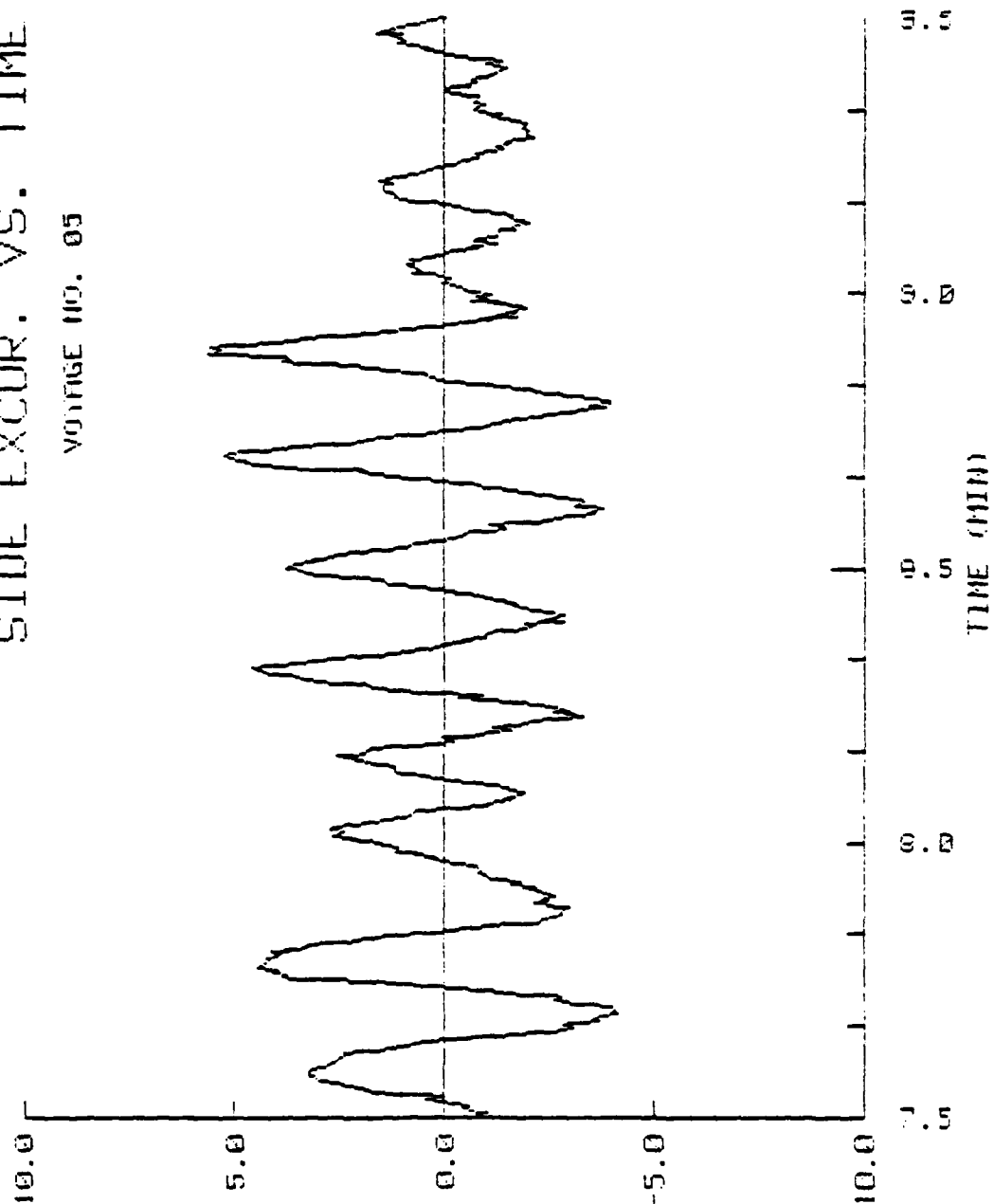
VOLTAJE 110. 05





SIDE EXCUR. VS. TIME

VOLUME NO. 05



SIDE EXCUR. (V)



# STATISTICAL SUMMARY

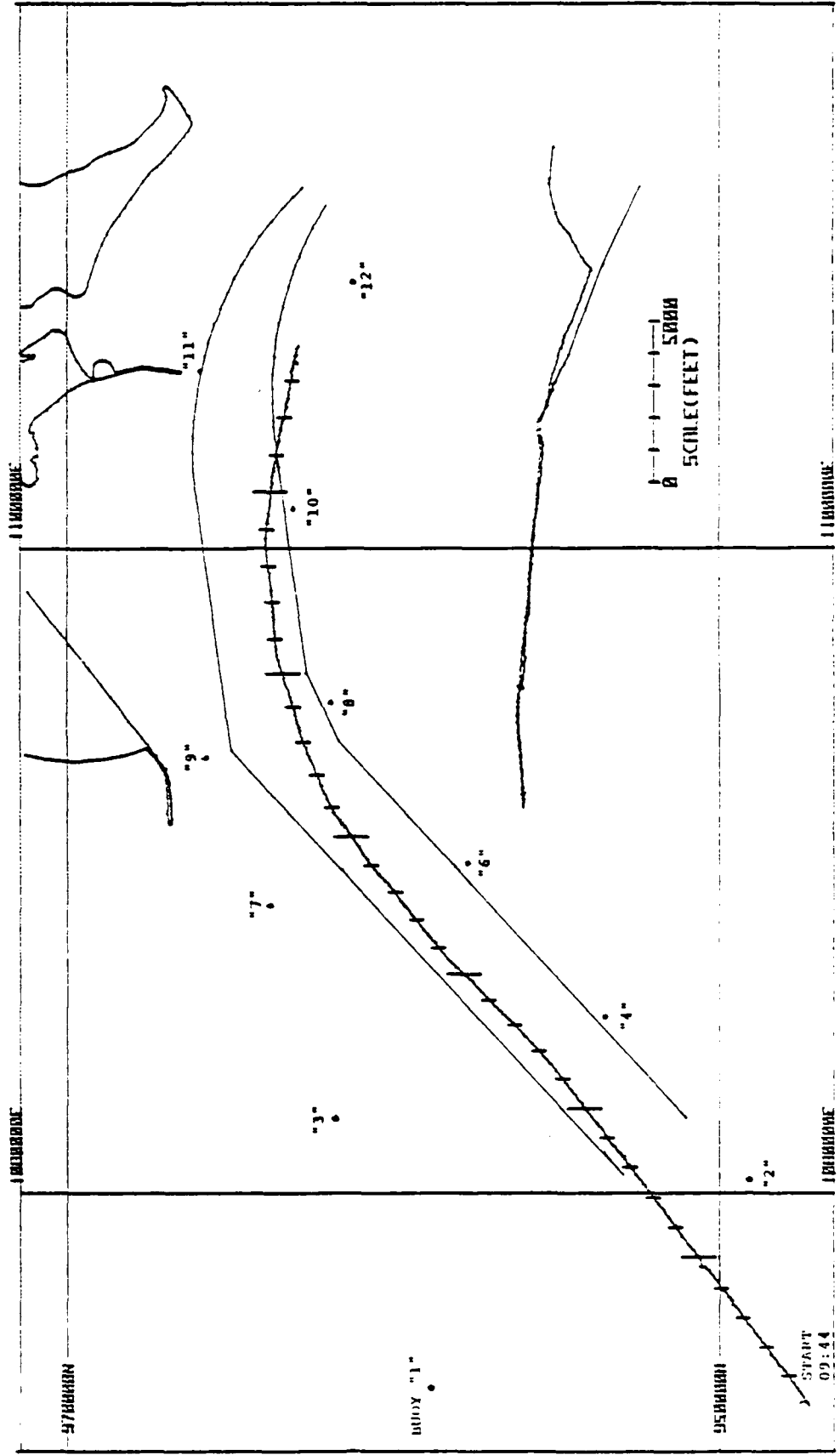
VOYAGE NO. 06

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.7	.9	.4	.4
ROLL (DEG)	1.0	2.8	1.3	1.5
ACC (FT/SEC/SEC)	-.0	1.7	.5	.5
HEAVE (FT)	.0	3.3	1.3	1.5
BOW EXCUR. (FT)	.0	7.8	2.9	3.4
STERN EXCUR. (FT)	.0	2.6	1.0	1.1
SIDE EXCUR (FT)	.0	4.4	1.9	2.1



# VOYAGE NO. 06 SHIP TRACK

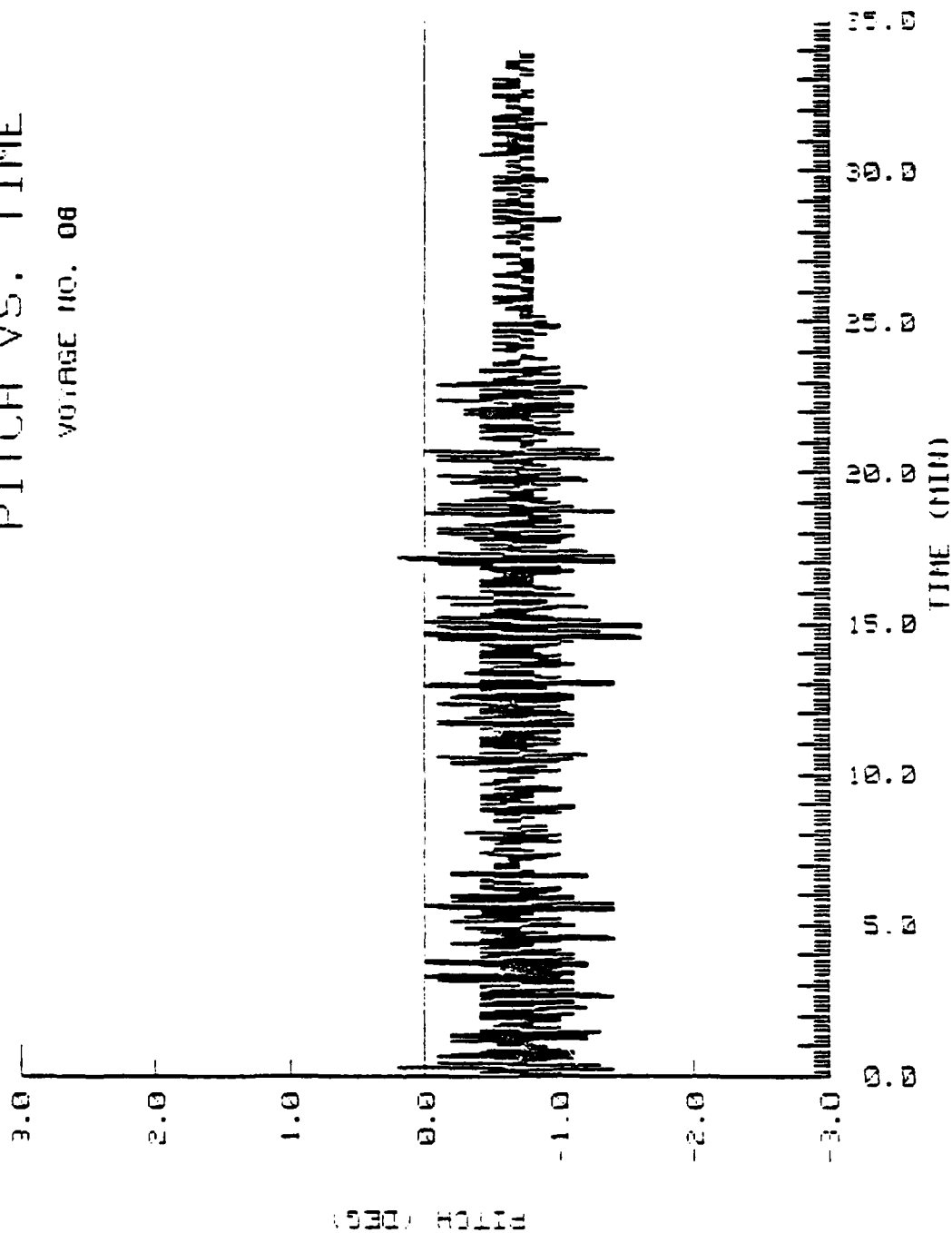
SCALE 1: 300000





# PITCH VS. TIME

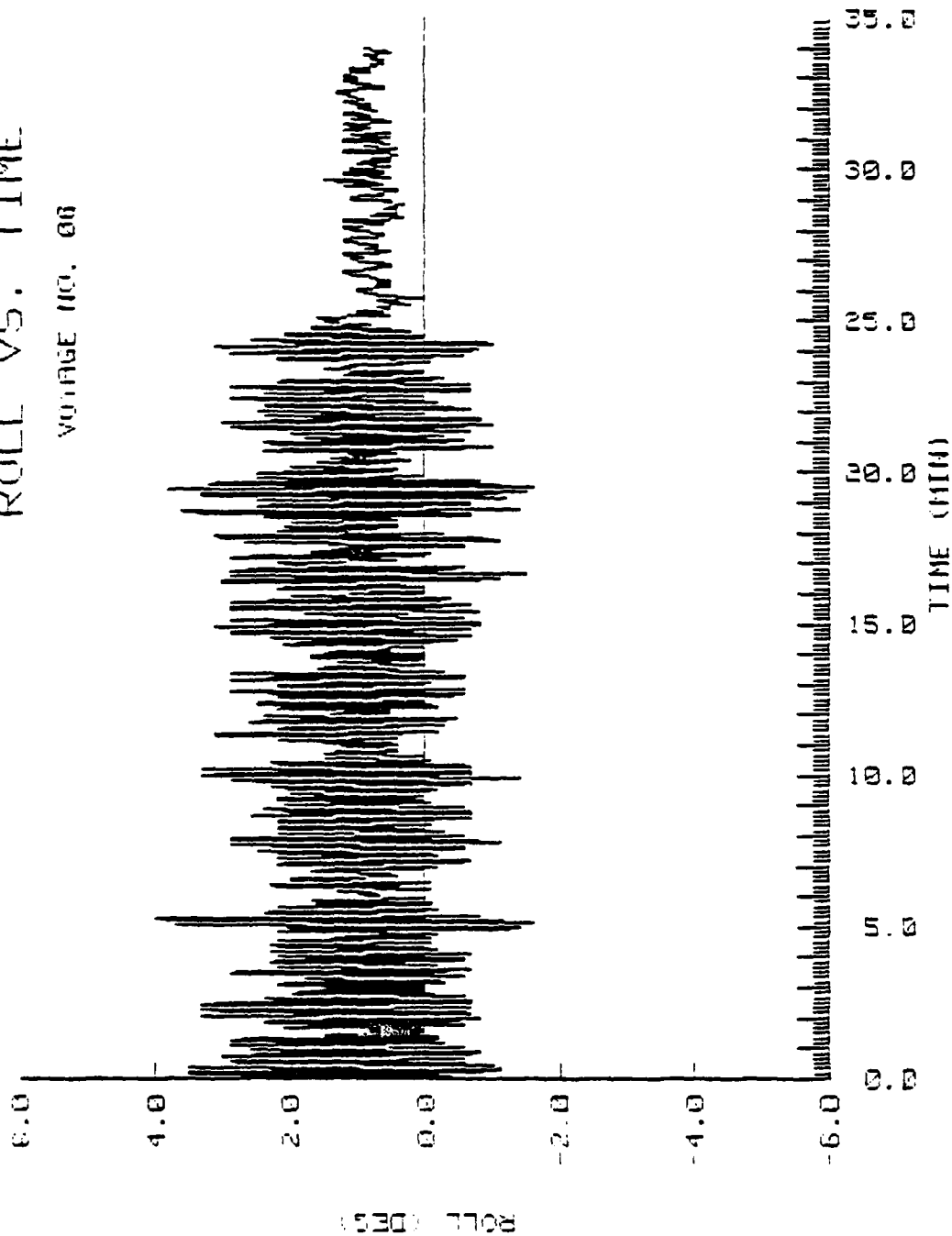
VOTAGE NO. 08





# ROLL VS. TIME

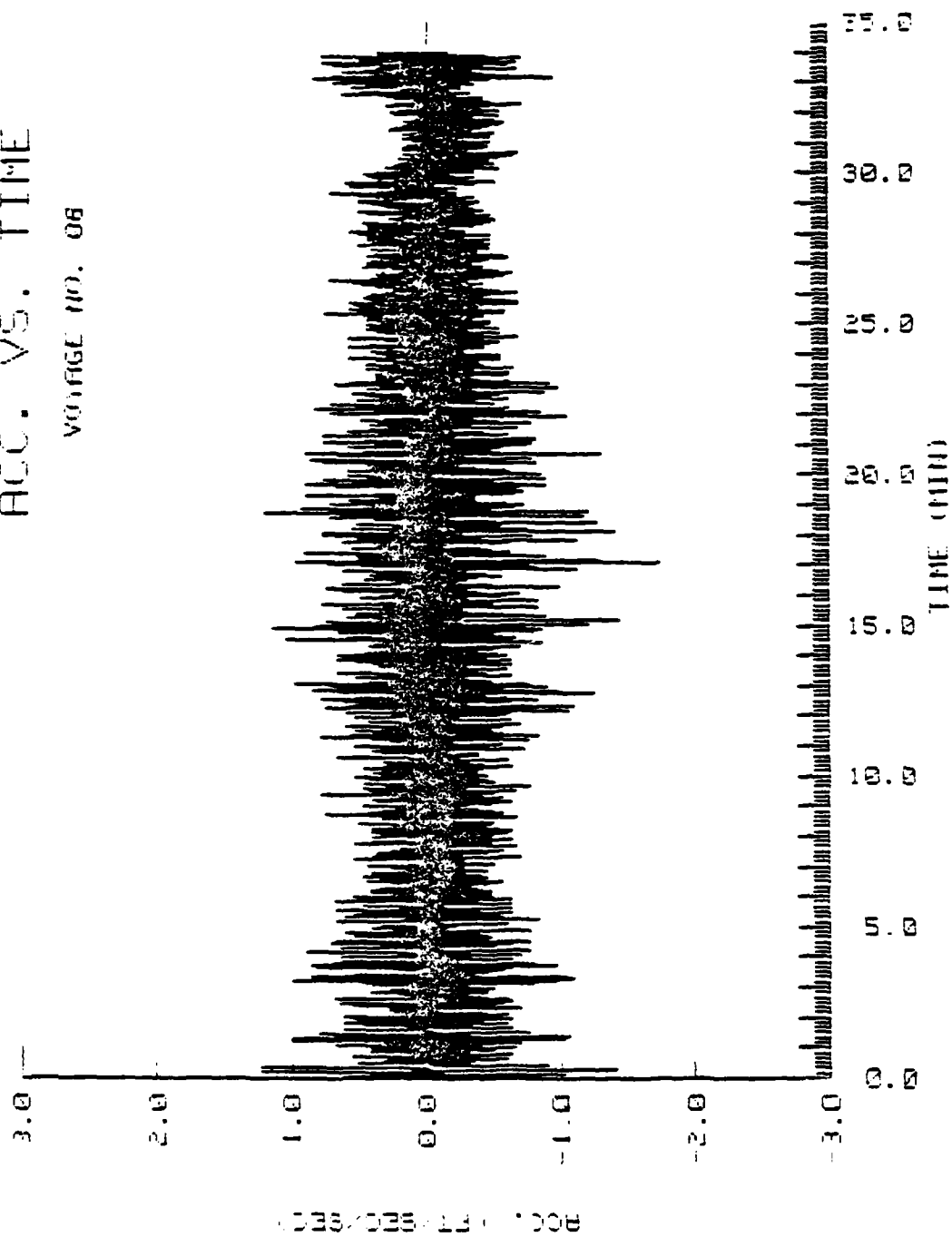
VOLUME 110, 00





# ACC. VS. TIME

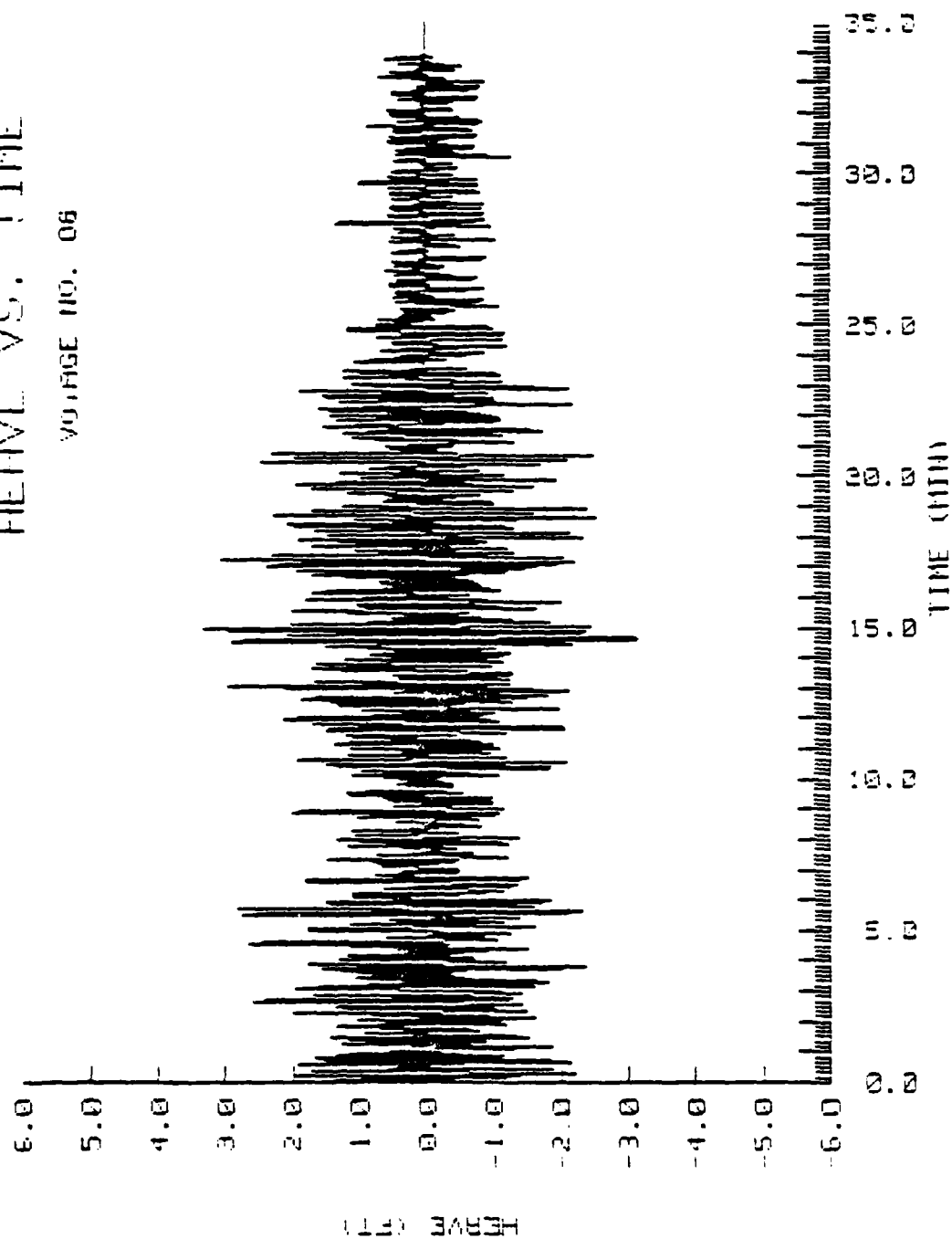
VOLUME NO. 08





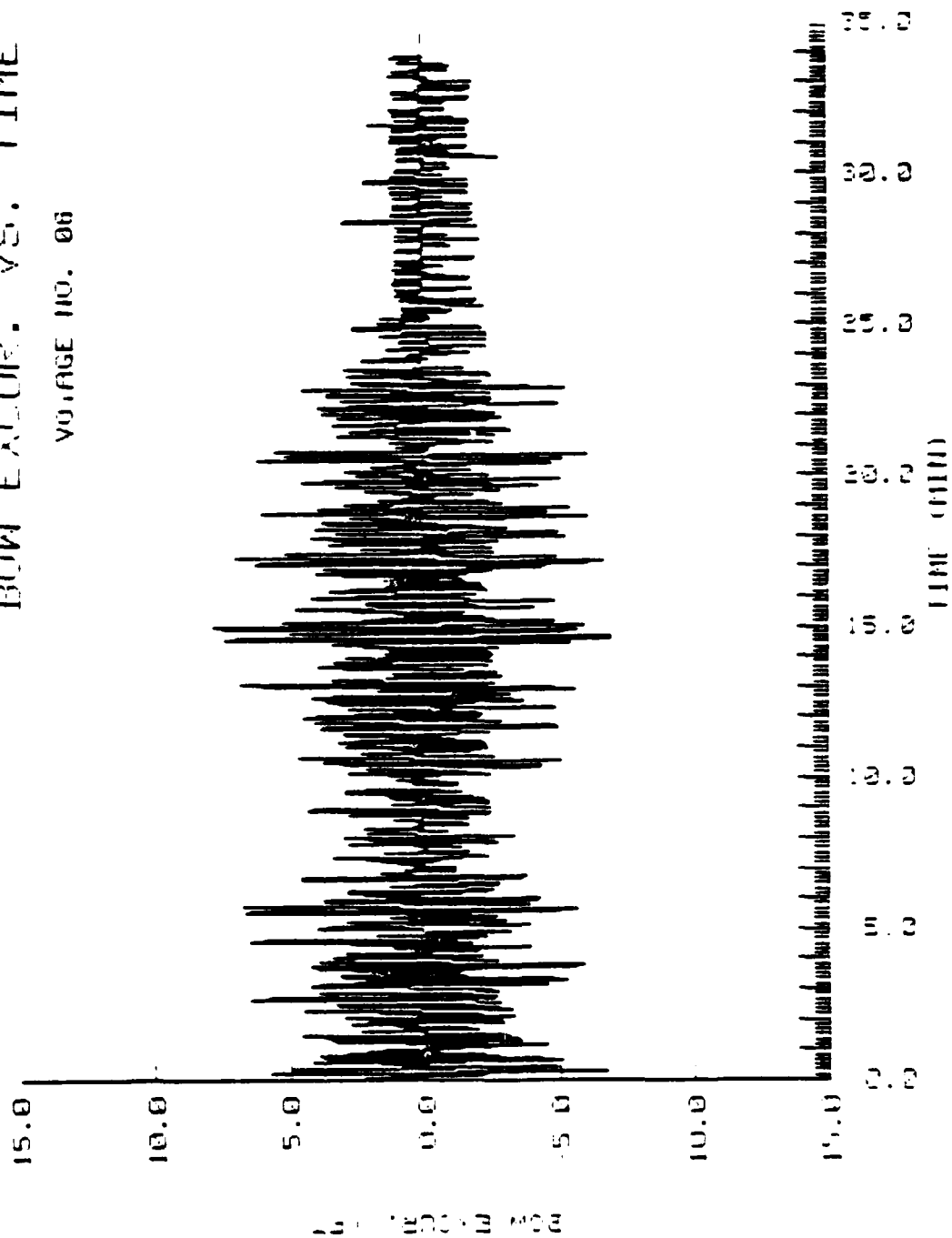
# HEAVL VS. TIME

VOLUME NO. 06





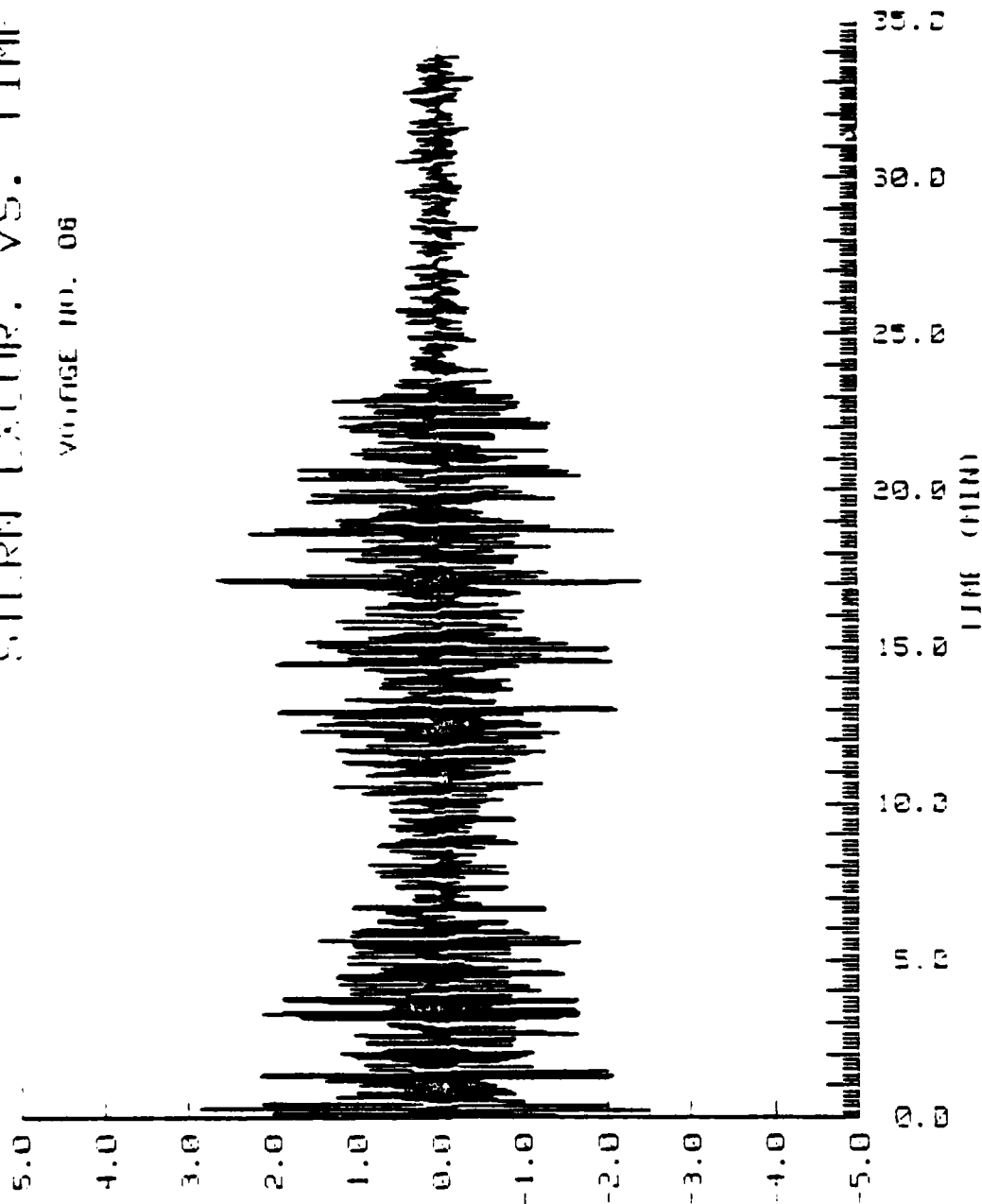
# BOW EXCUR. VS. TIME VOLTAGE 110. 06





# STERN EXCUR. VS. TIME

VOLUME NO. 06

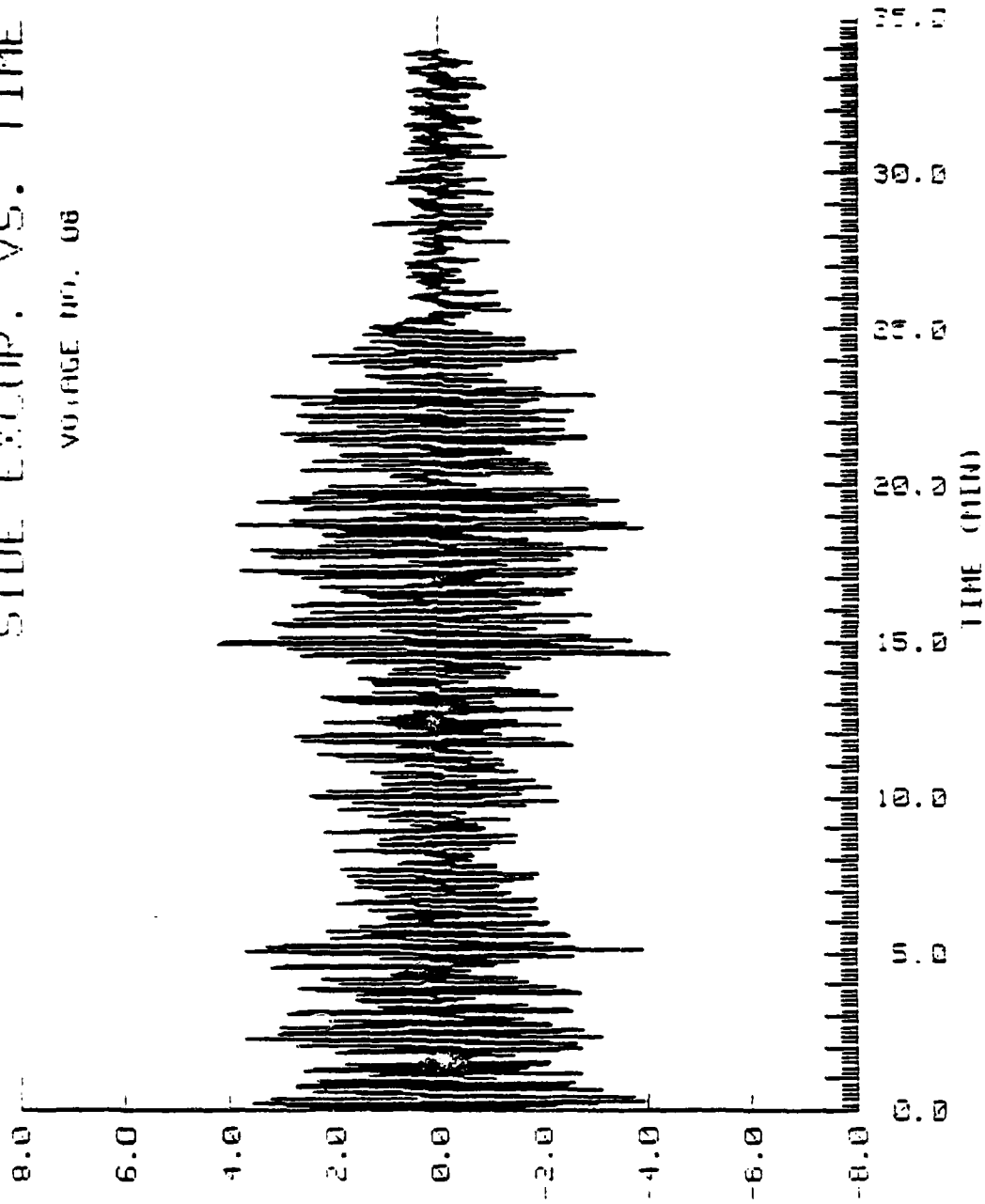


STERN EXCUR.



# SIDE EXCUR. VS. TIME

VOLAGE NO. 08



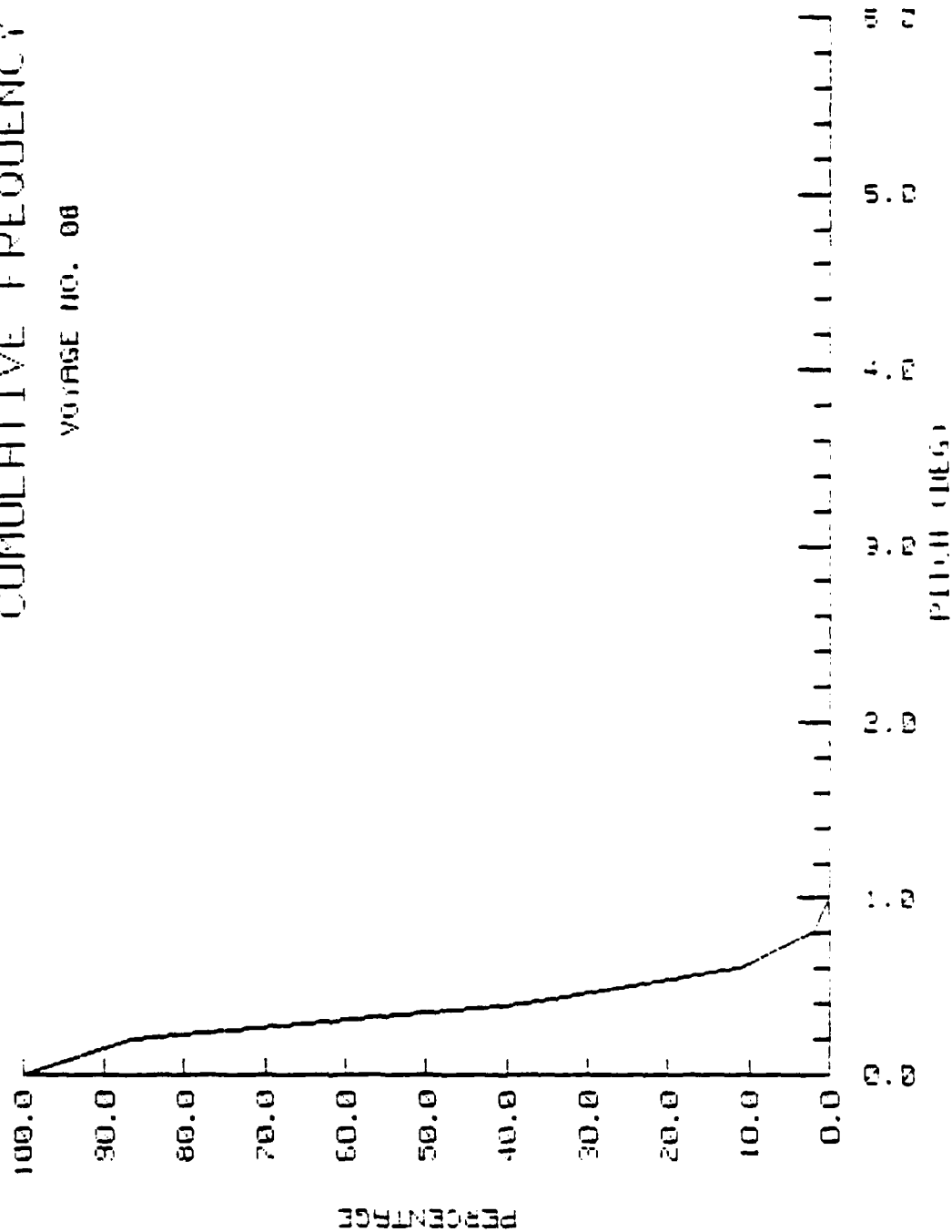
SIDE EXCUR. (FT)

TIME (MIN)



# CUMULATIVE FREQUENCY

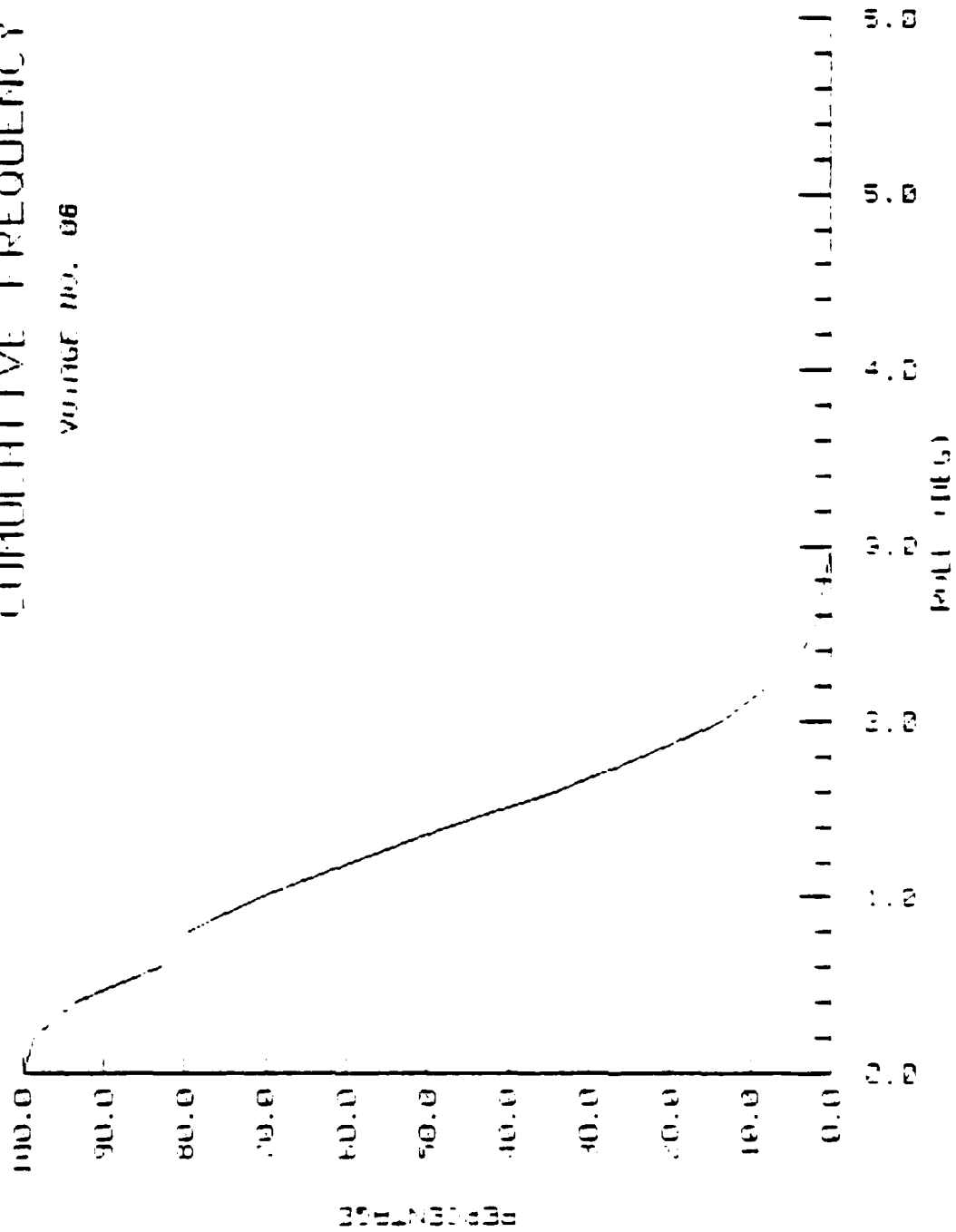
VOTAGE NO. 00





# CUMULATIVE FREQUENCY

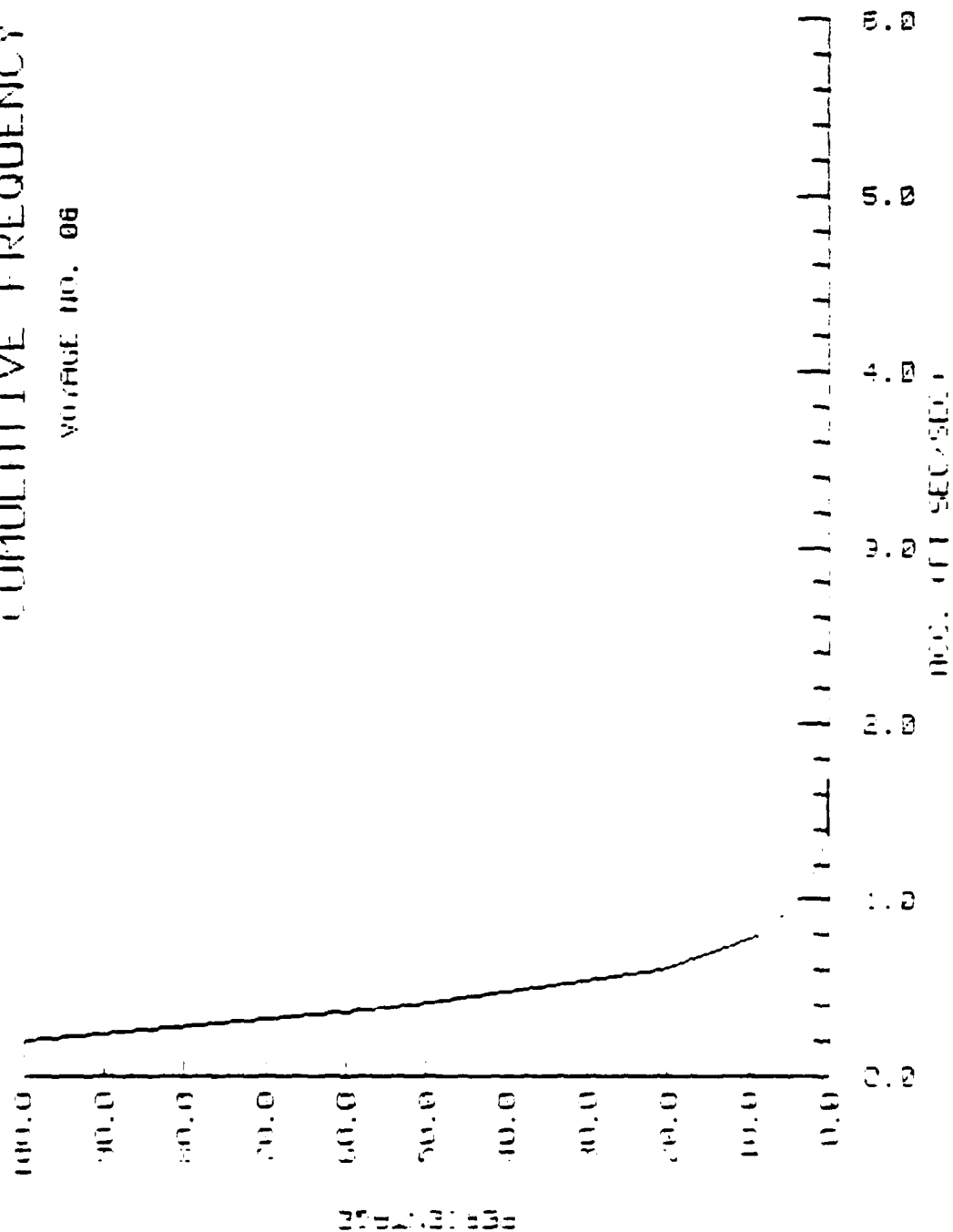
YOUNG NO. 06





# CUMULATIVE FREQUENCY

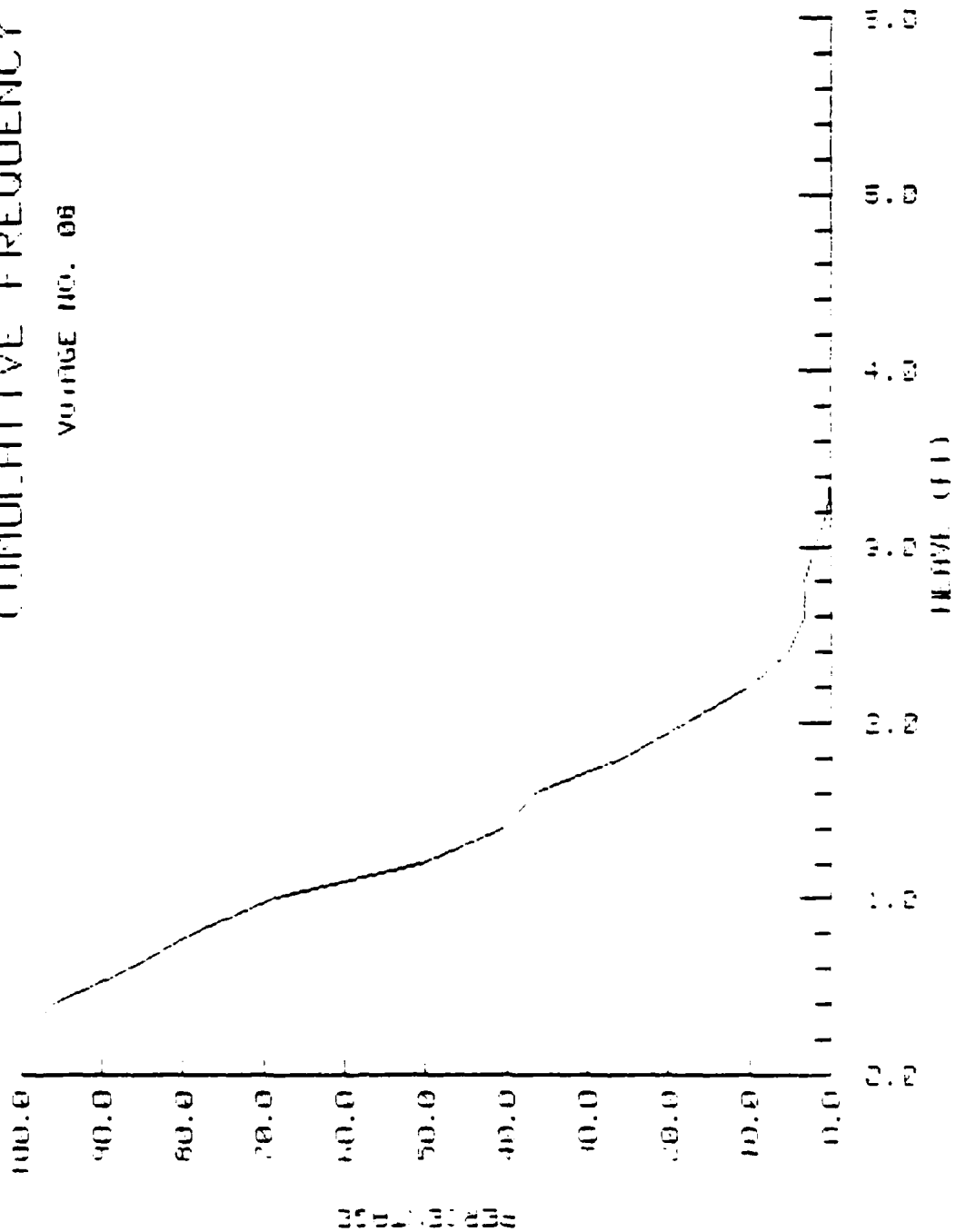
VOLAGE NO. 08





# CUMULATIVE FREQUENCY

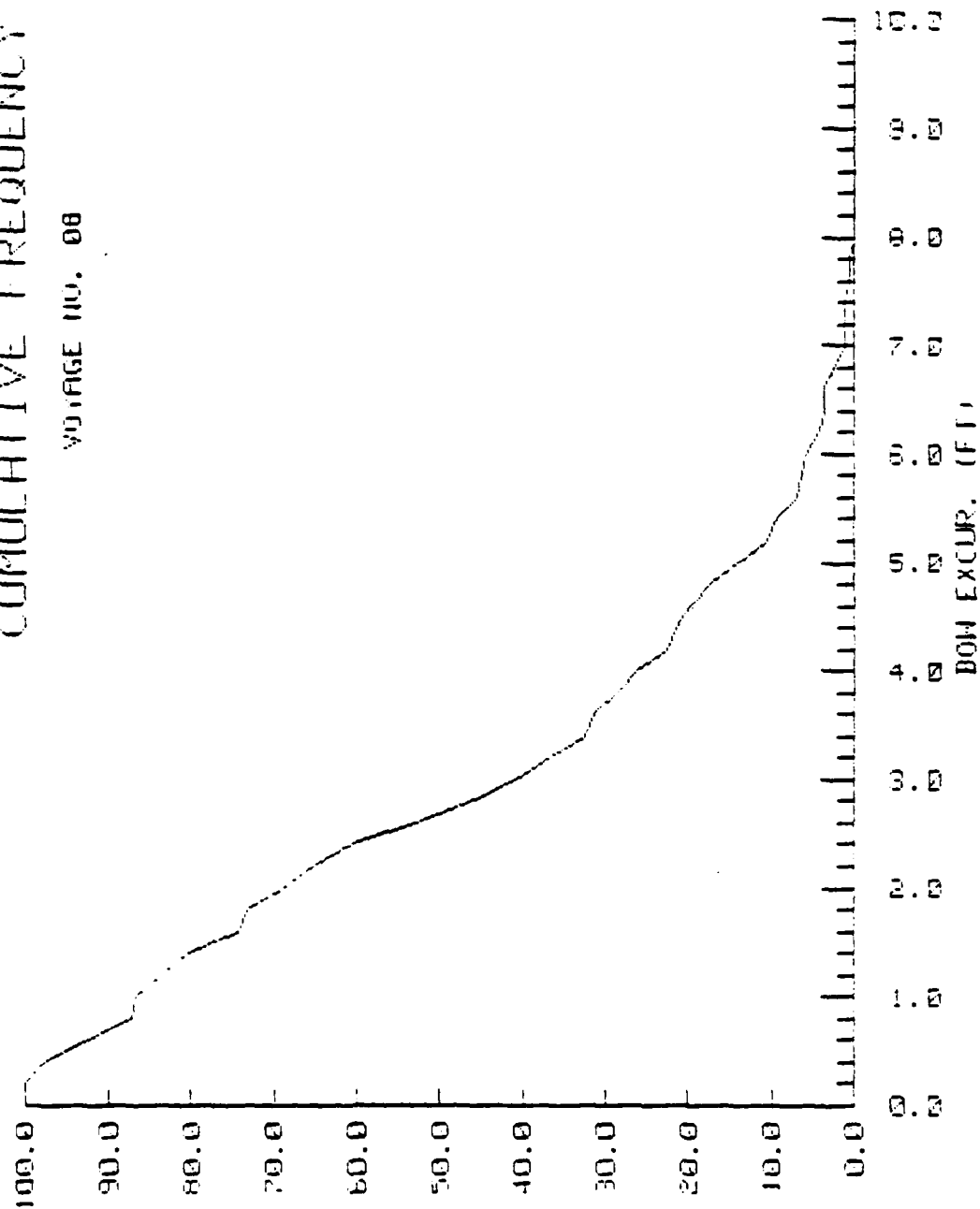
VOLUME NO. 08





# CUMULATIVE FREQUENCY

VOLAGE NO. 08

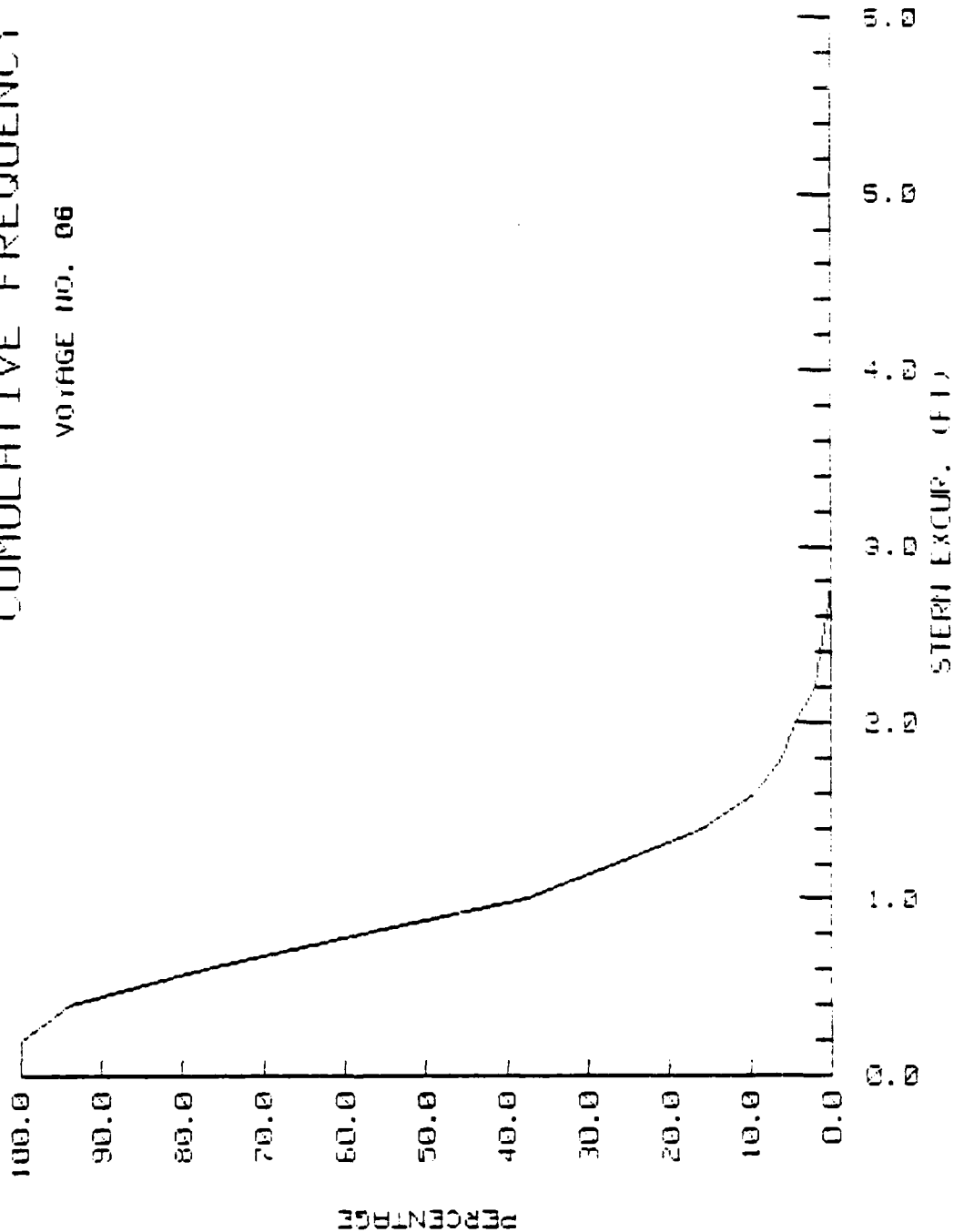


25-11-130630



# CUMULATIVE FREQUENCY

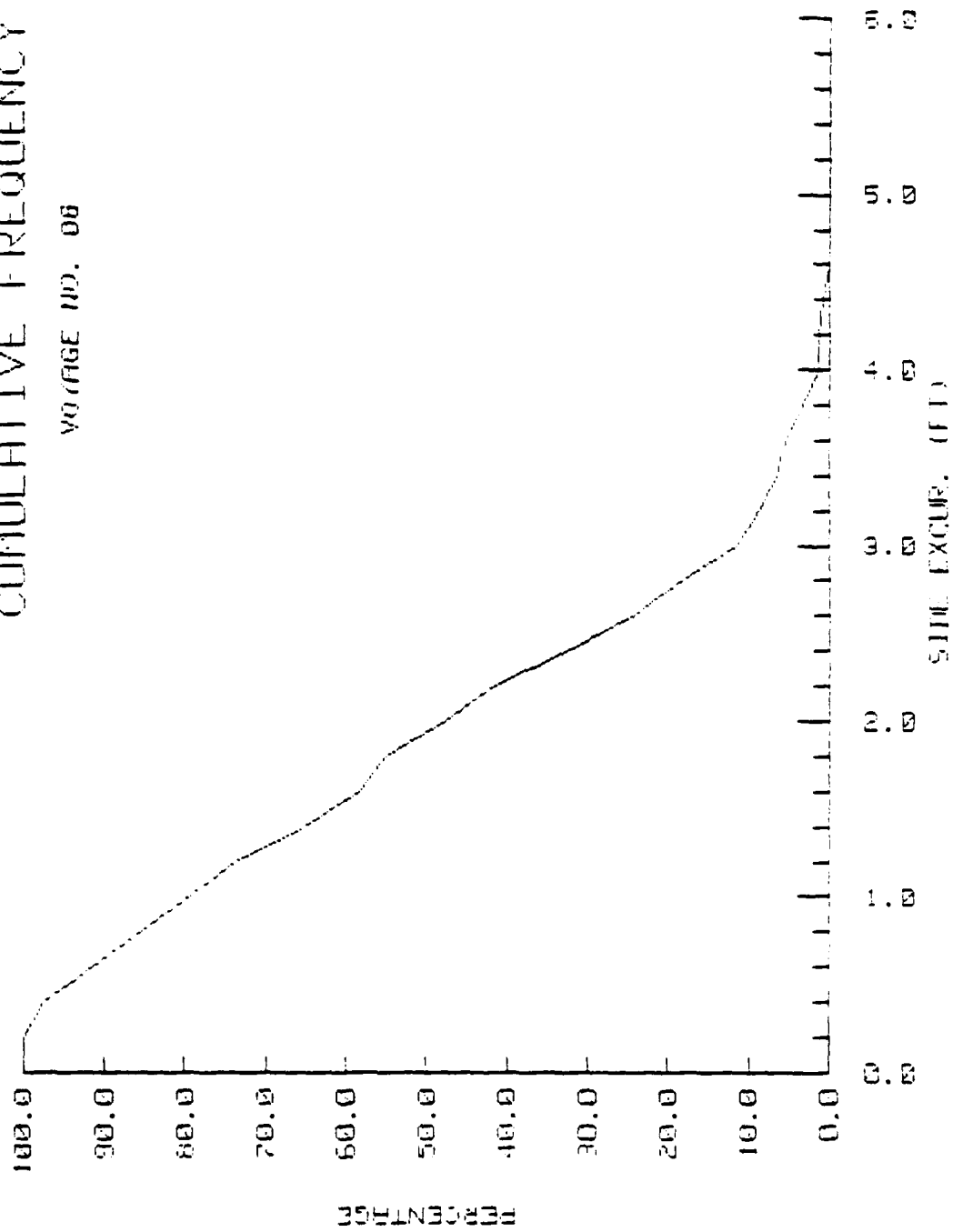
VOTAGE 100. 06





# CUMULATIVE FREQUENCY

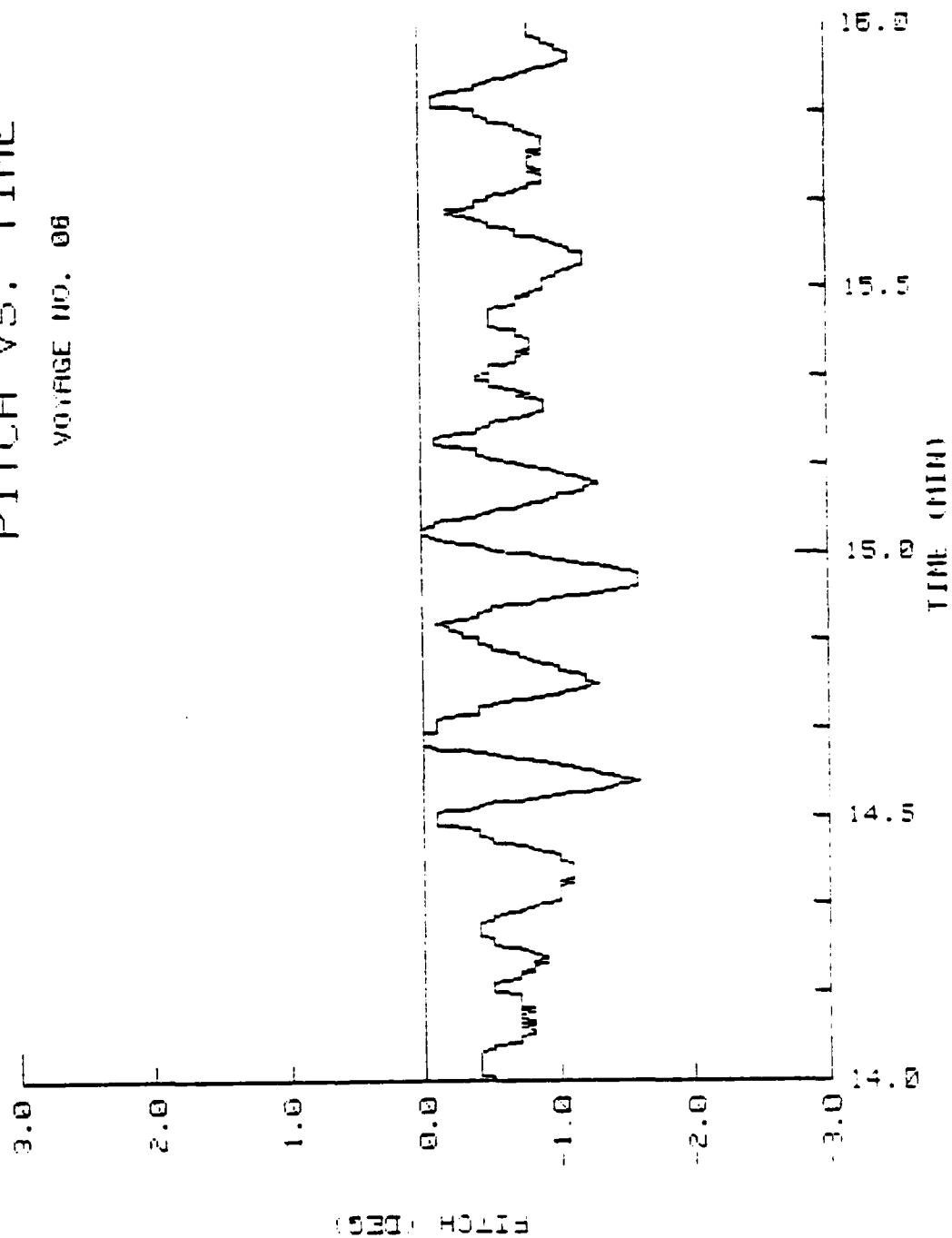
VOLAGE NO. 08





# PITCH VS. TIME

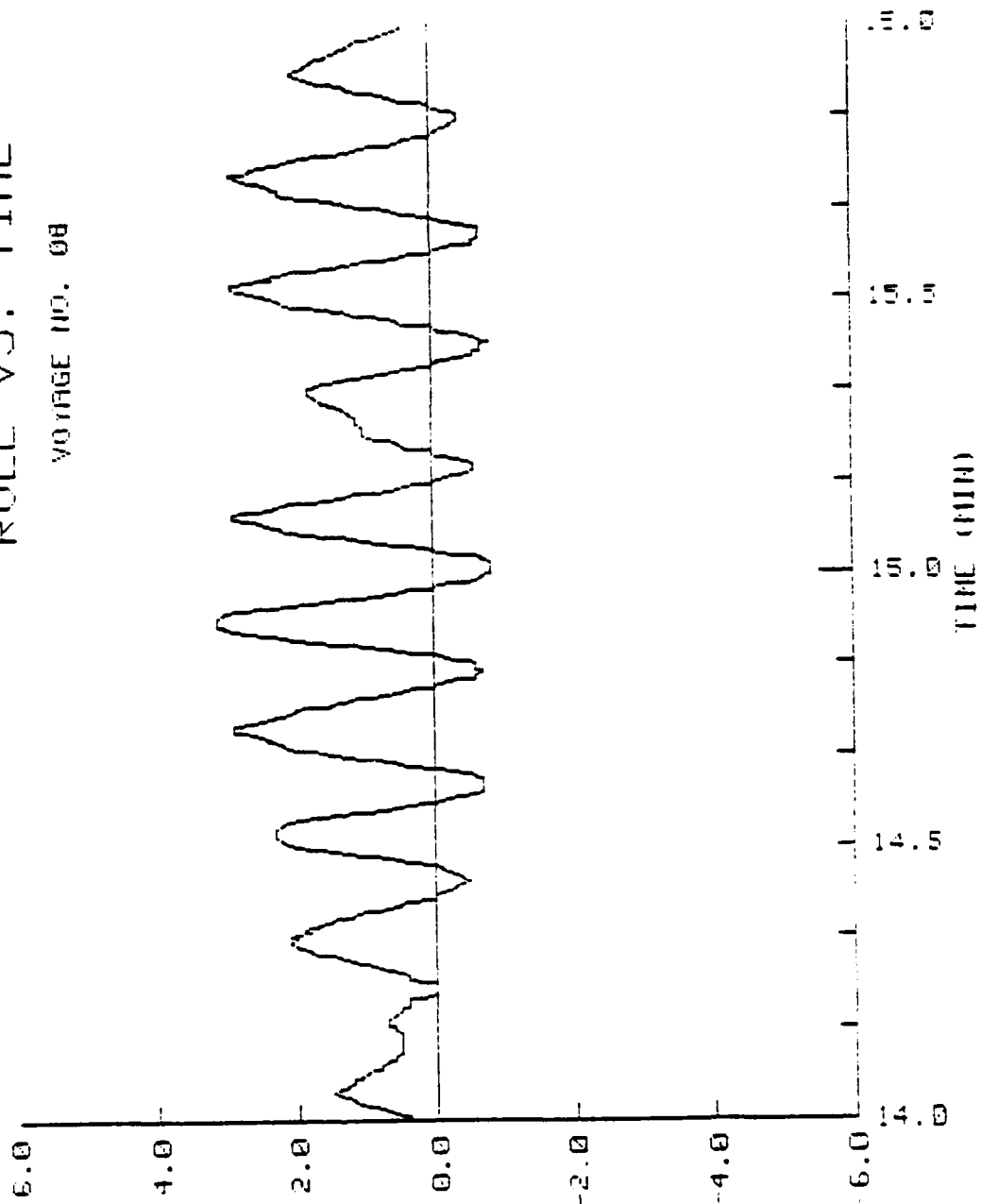
VOYAGE NO. 06





# ROLL VS. TIME

VOLTAGE NO. 08

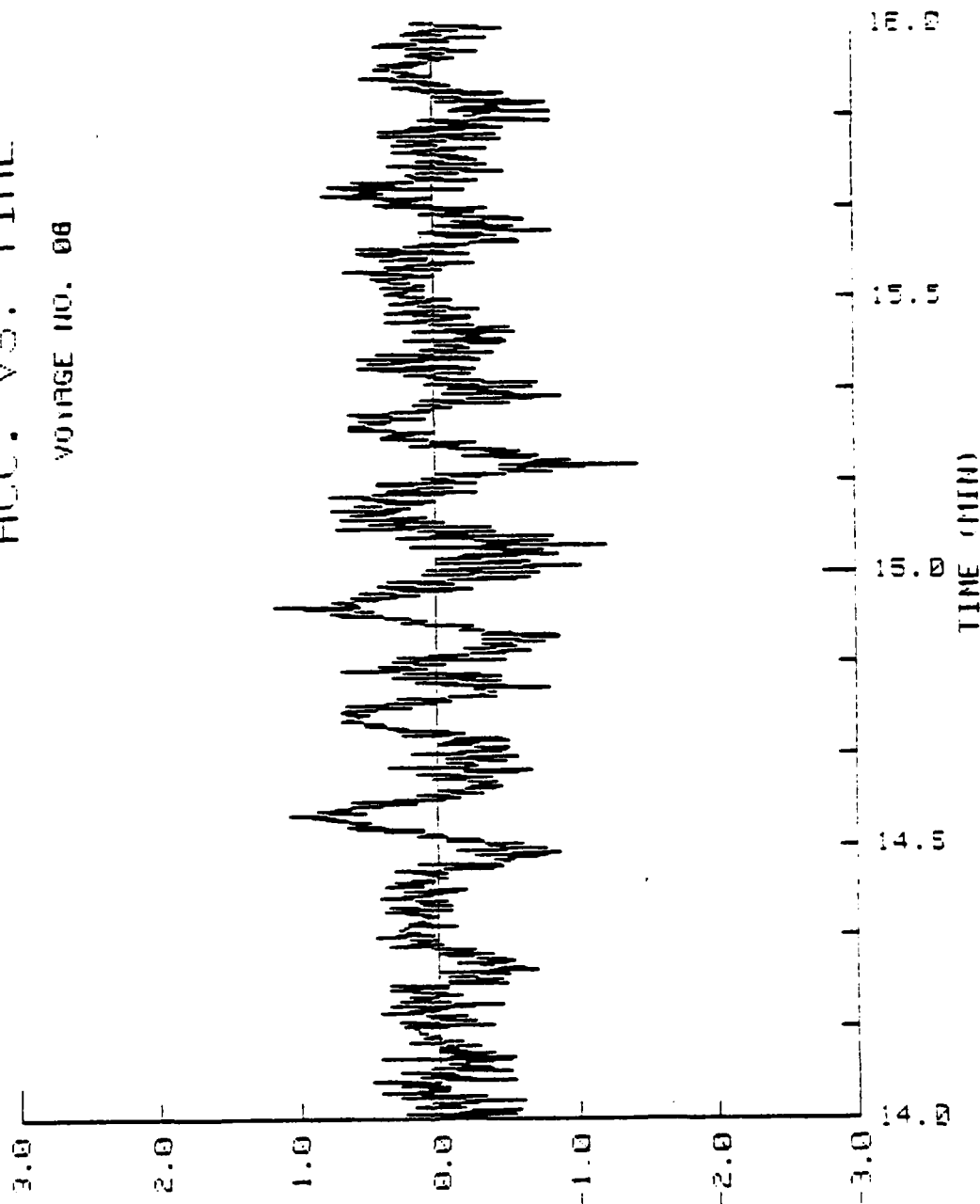


ROLL (DEG)



ACC. VS. TIME

VOLUME NO. 06

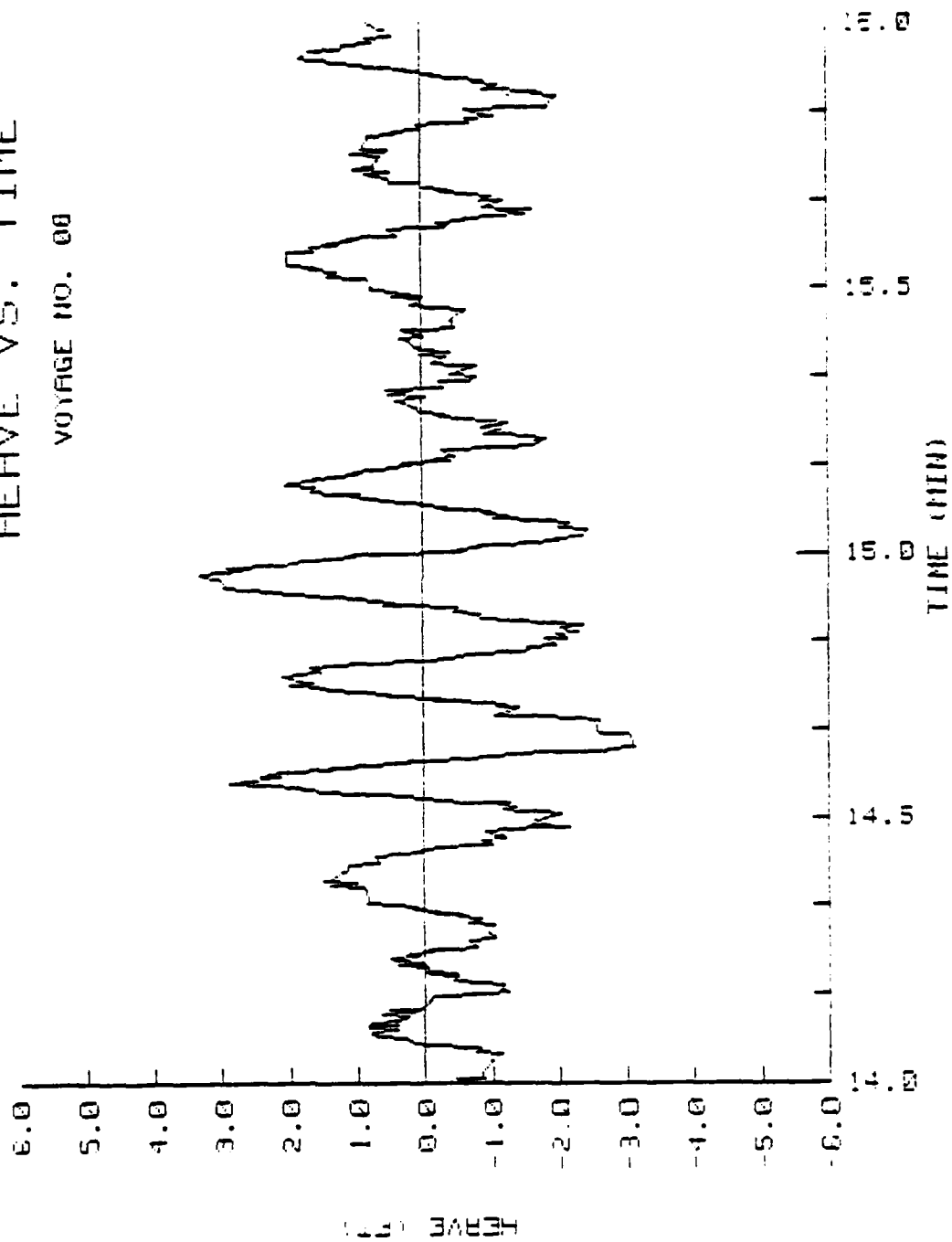


ACC. VS. TIME



# HEAVE VS. TIME

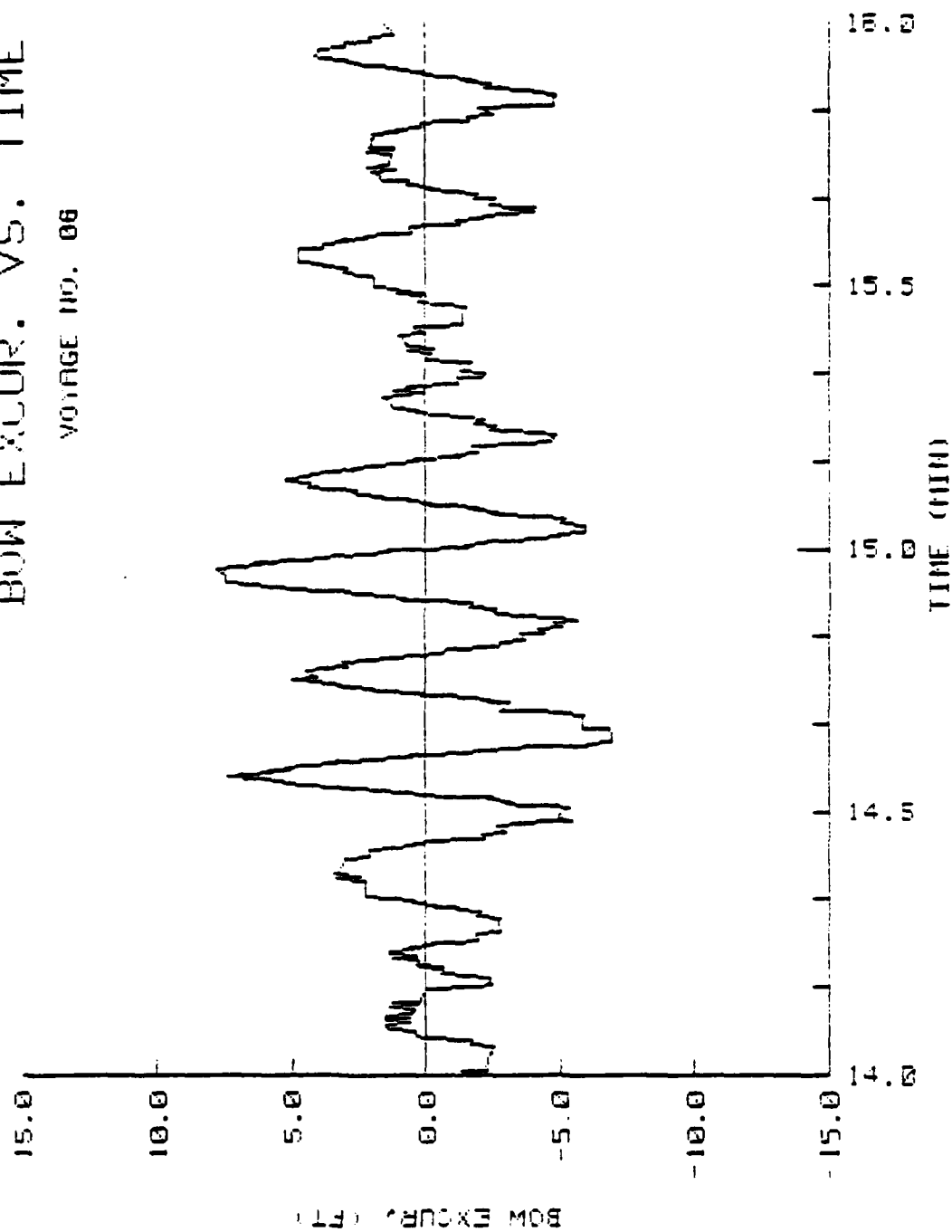
VOYAGE NO. 08





# BOW EXCUR. VS. TIME

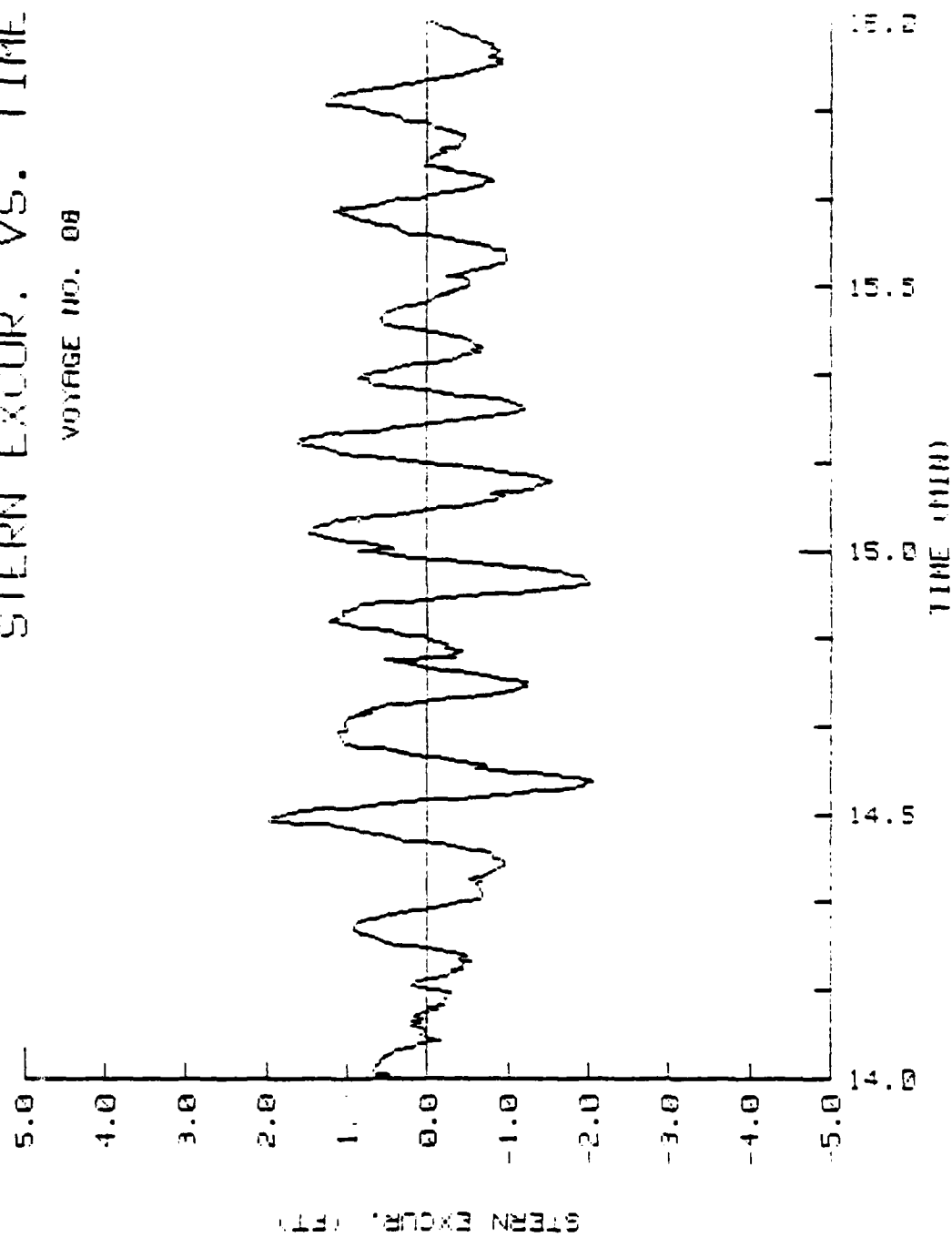
VOLUME NO. 06





# STERN EXCUR. VS. TIME

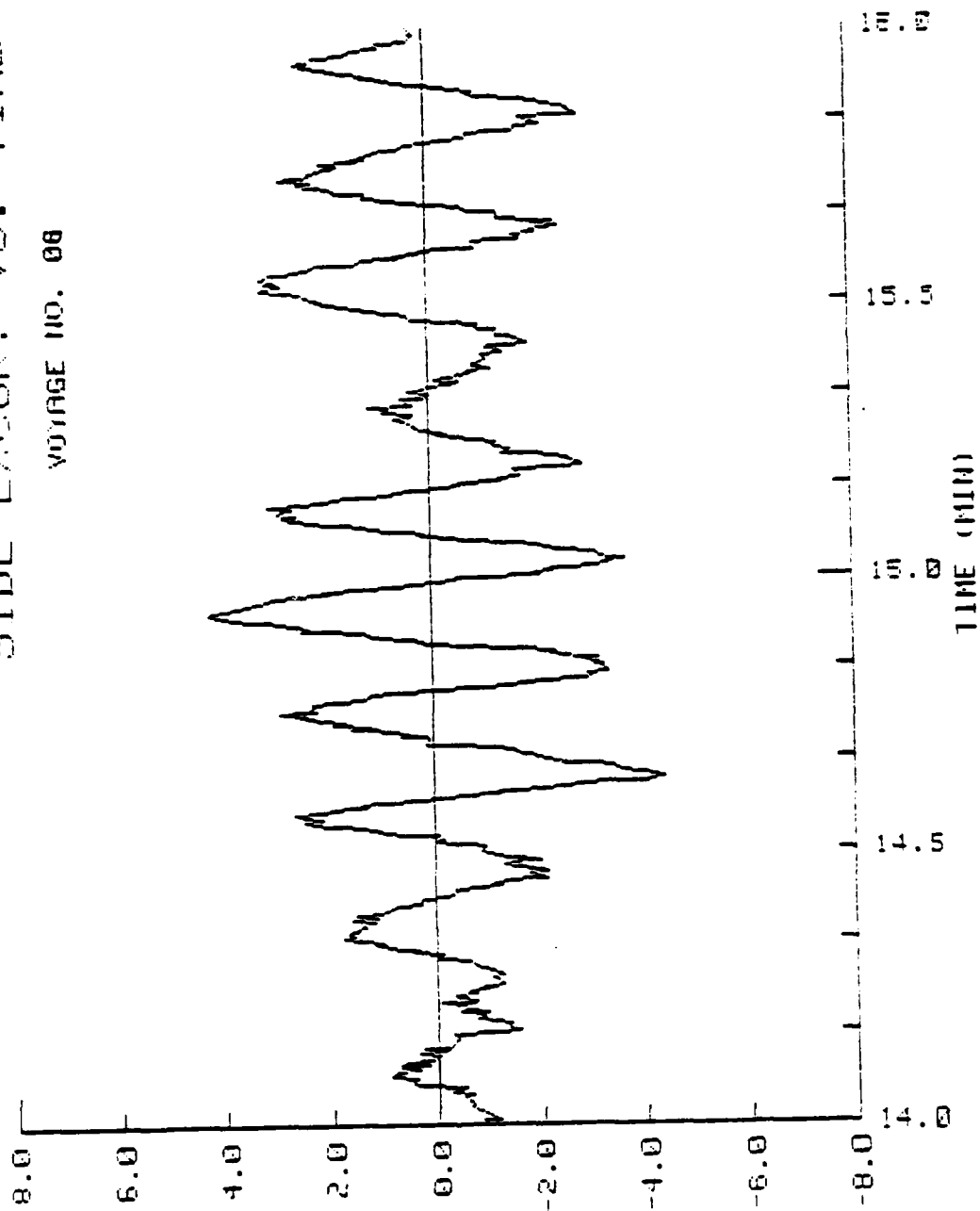
VOYAGE NO. 08





# SIDE EXCUR. VS. TIME

VOTAGE NO. 08



SIDE EXCUR. (V)



# STATISTICAL SUMMARY

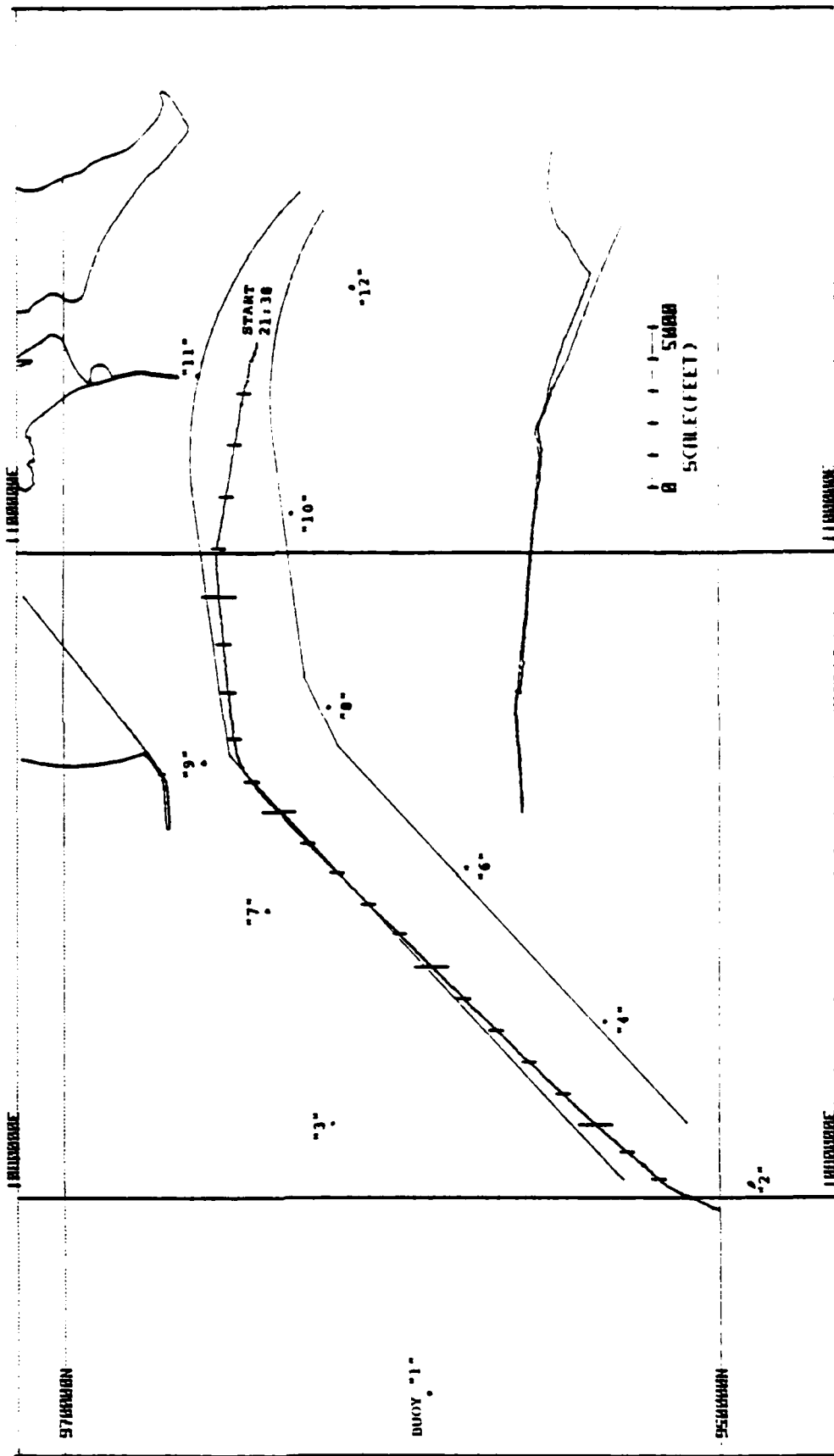
VOYAGE NO. 07

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.3	.9	.4	.4
ROLL (DEG)	.2	1.3	.5	.5
YAW (FT/SEC/SEC)	.0	1.9	.8	.8
HEAVE (FT)	.0	3.5	1.6	1.7
BOW EXCUR. (FT)	-.0	7.9	3.0	3.4
STERN EXCUR. (FT)	.0	2.5	1.2	1.3
SIDE EXCUR (FT)	.0	3.4	1.6	1.7



# VOYAGE NO. 07 SHIP TRACK

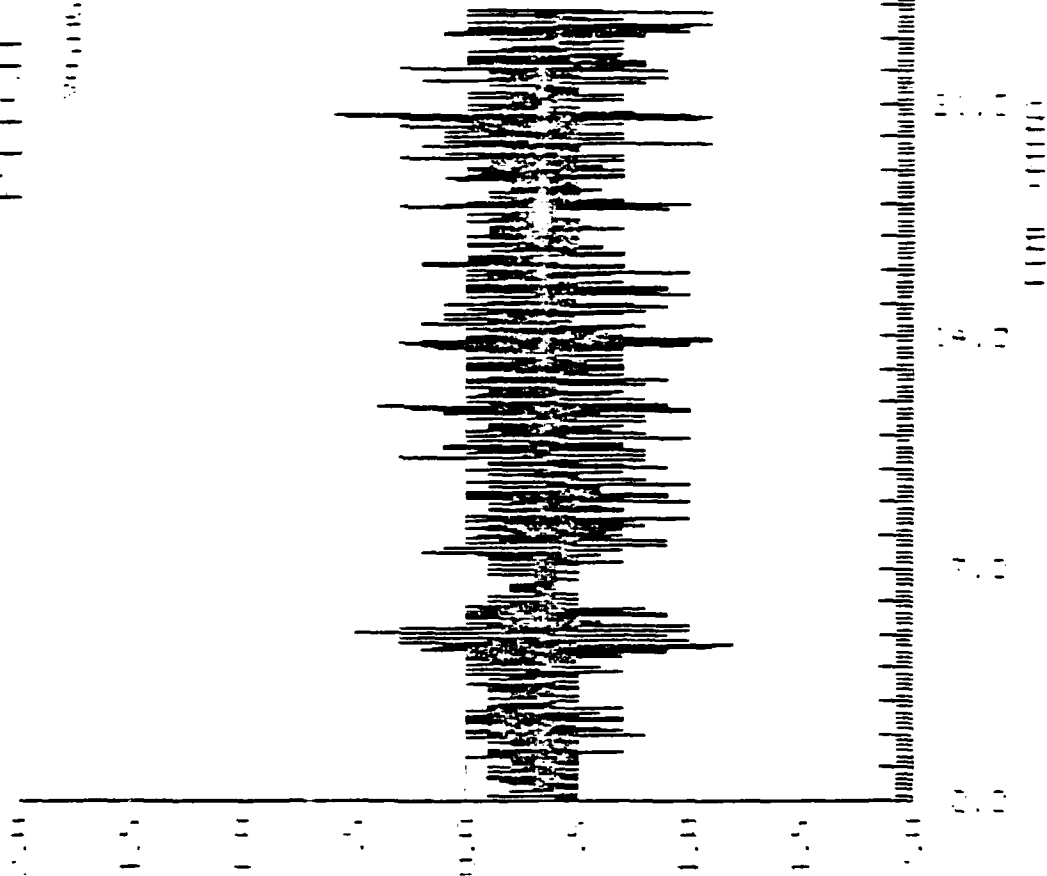
SCALE 1: 30000





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100





100

**THE**

100

1. *Introduction*



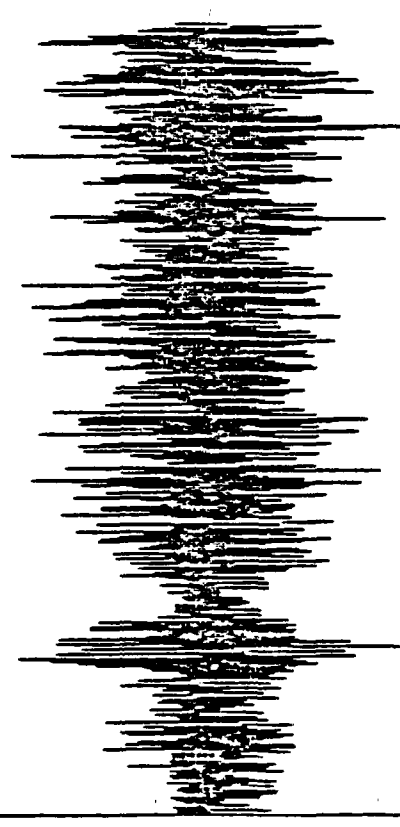




# RECEIVED TIME

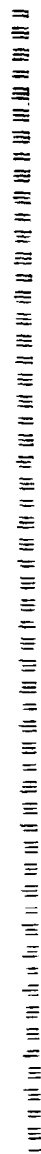
WINTER 1900, 02

0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 19.00 20.00 21.00 22.00 23.00 24.00 25.00 26.00 27.00 28.00 29.00 30.00 31.00 32.00 33.00 34.00 35.00 36.00 37.00 38.00 39.00 40.00 41.00 42.00 43.00 44.00 45.00 46.00 47.00 48.00 49.00 50.00 51.00 52.00 53.00 54.00 55.00 56.00 57.00 58.00 59.00 60.00 61.00 62.00 63.00 64.00 65.00 66.00 67.00 68.00 69.00 70.00 71.00 72.00 73.00 74.00 75.00 76.00 77.00 78.00 79.00 80.00 81.00 82.00 83.00 84.00 85.00 86.00 87.00 88.00 89.00 90.00 91.00 92.00 93.00 94.00 95.00 96.00 97.00 98.00 99.00 100.00



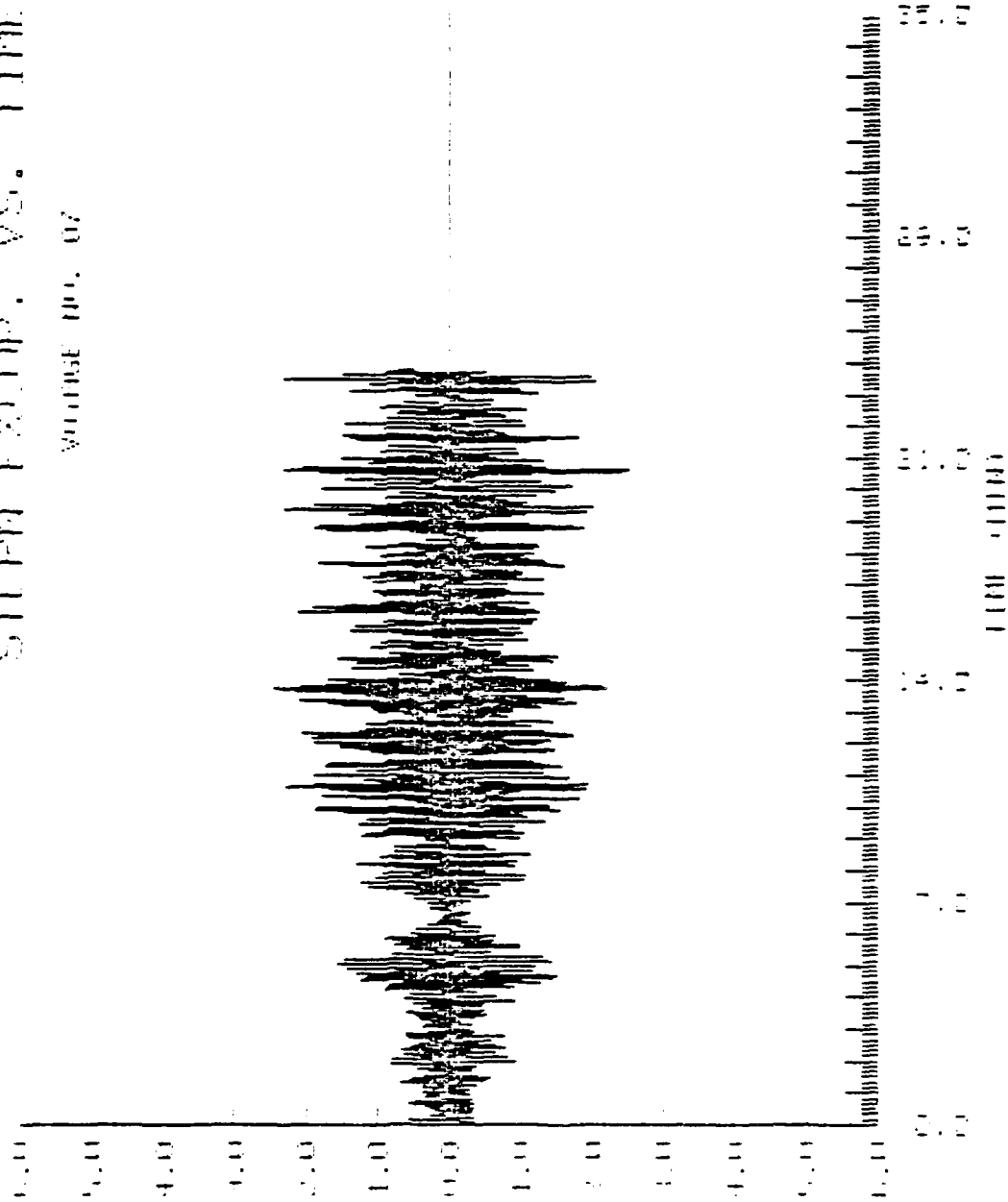
1000







WILLIAM.

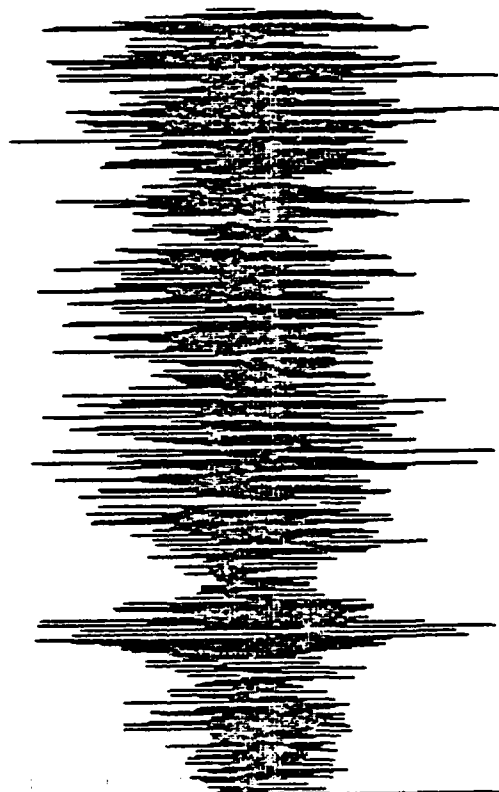




# 51114 LSCALP2 VS. TIME

WORLDWIDE INC. 07

1.00  
0.50  
0.00  
-0.50  
-1.00  
-1.50  
-2.00  
-2.50  
-3.00  
-3.50  
-4.00  
-4.50  
-5.00



1.00 0.50 0.00 -0.50 -1.00 -1.50 -2.00 -2.50 -3.00 -3.50 -4.00 -4.50 -5.00

1.00 0.50 0.00 -0.50 -1.00 -1.50 -2.00 -2.50 -3.00 -3.50 -4.00 -4.50 -5.00

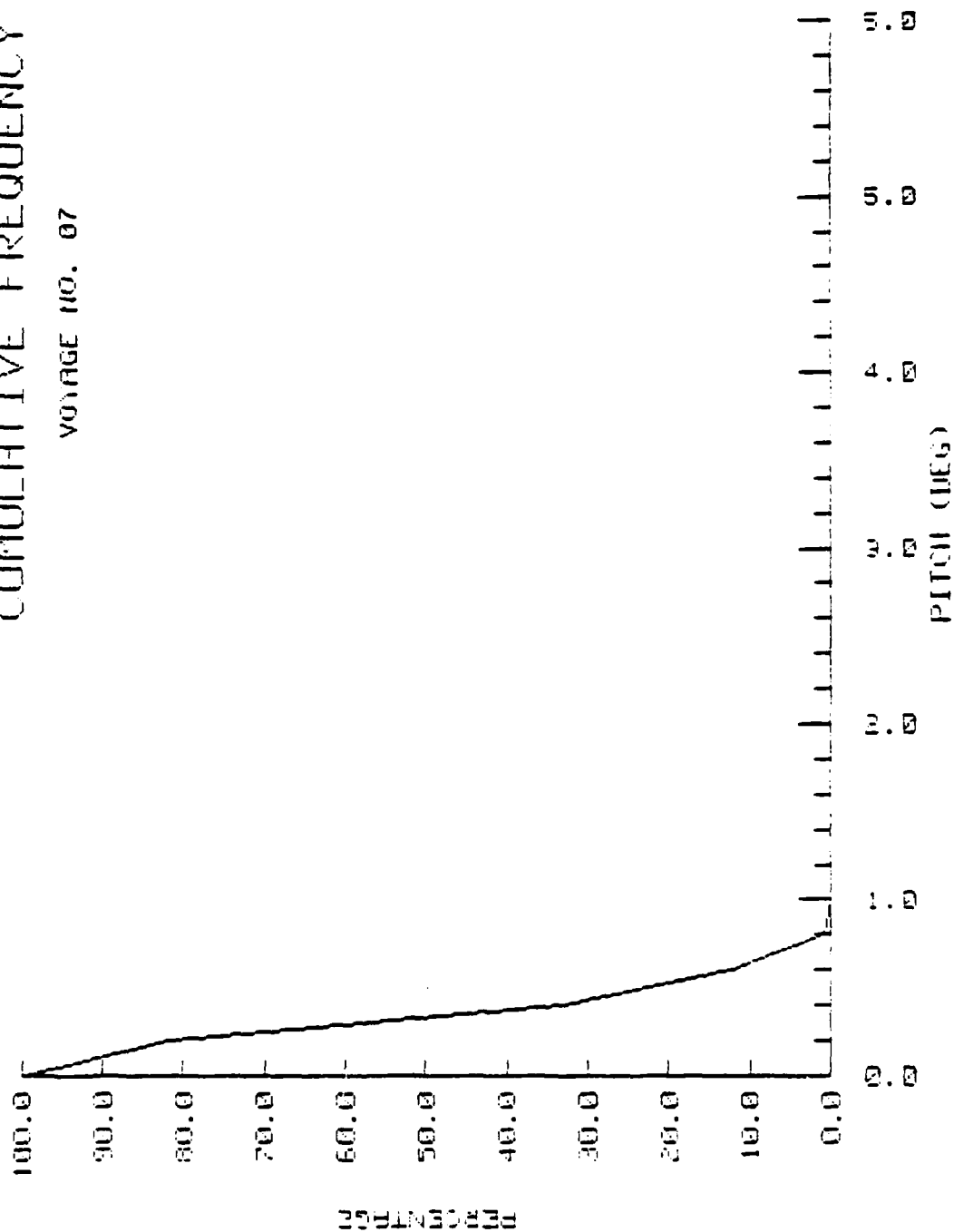
1.00 0.50 0.00 -0.50 -1.00 -1.50 -2.00 -2.50 -3.00 -3.50 -4.00 -4.50 -5.00

TIME (SECONDS)



# CUMULATIVE FREQUENCY

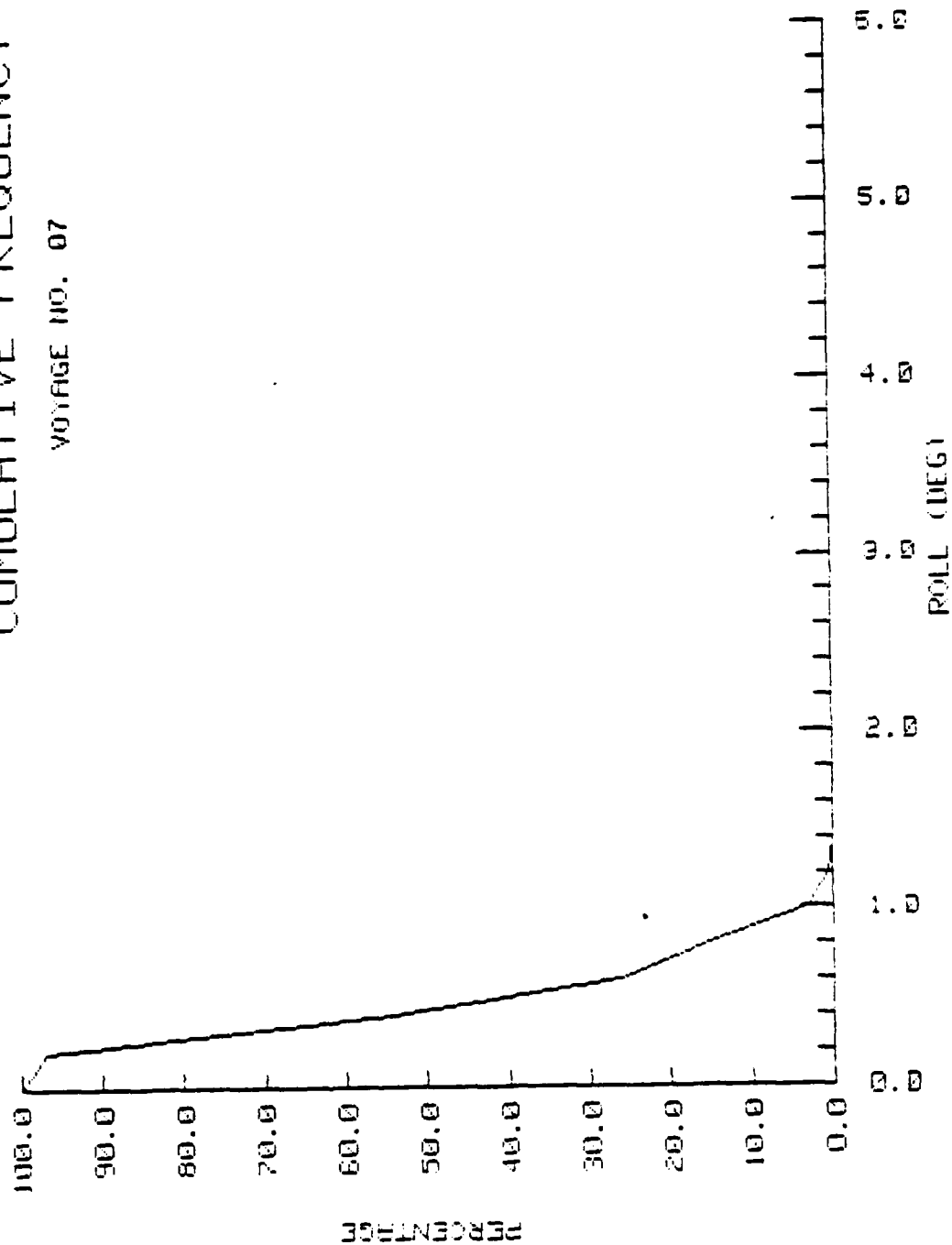
VOLAGE NO. 07





# CUMULATIVE FREQUENCY

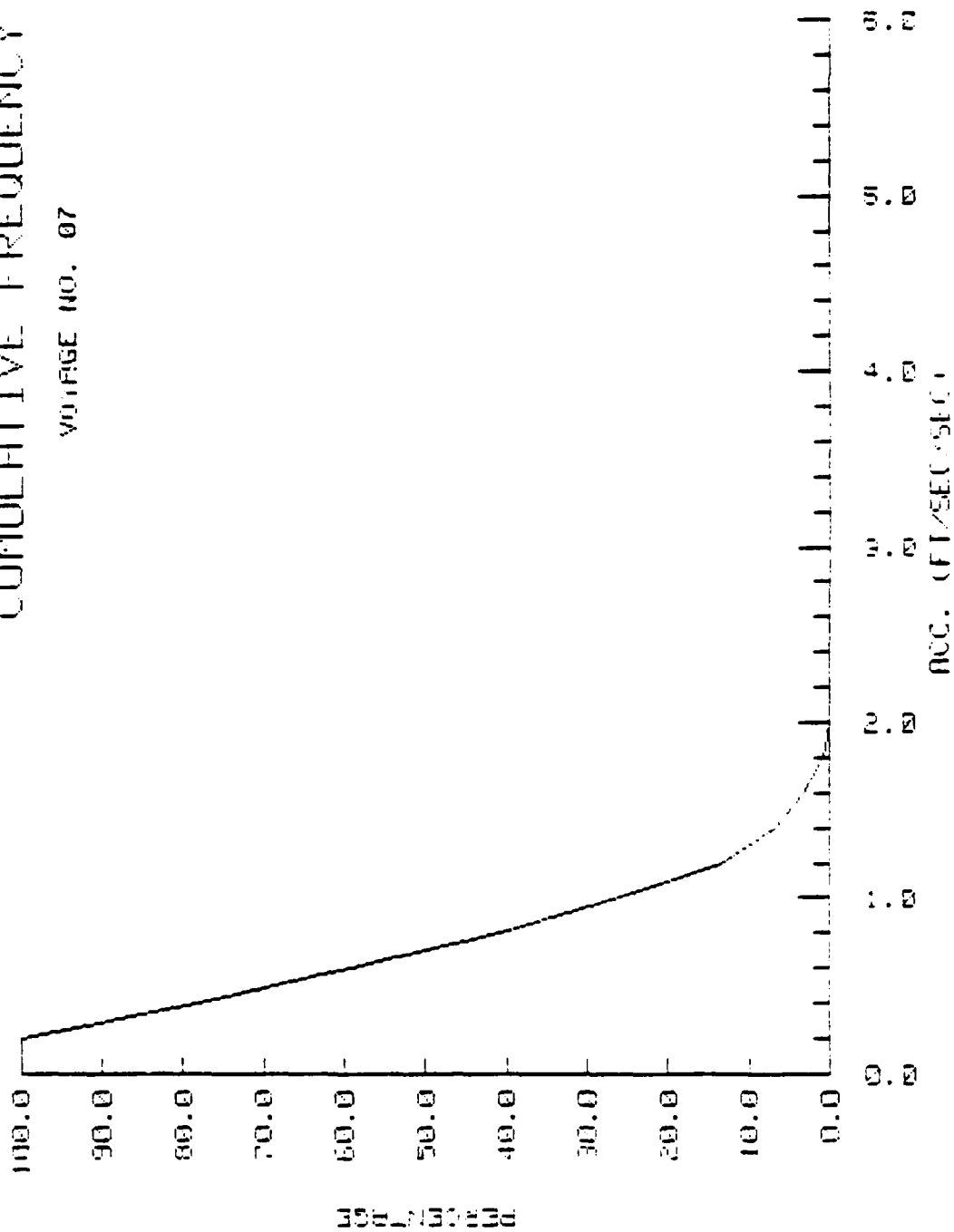
VOYAGE NO. 07





# CUMULATIVE FREQUENCY

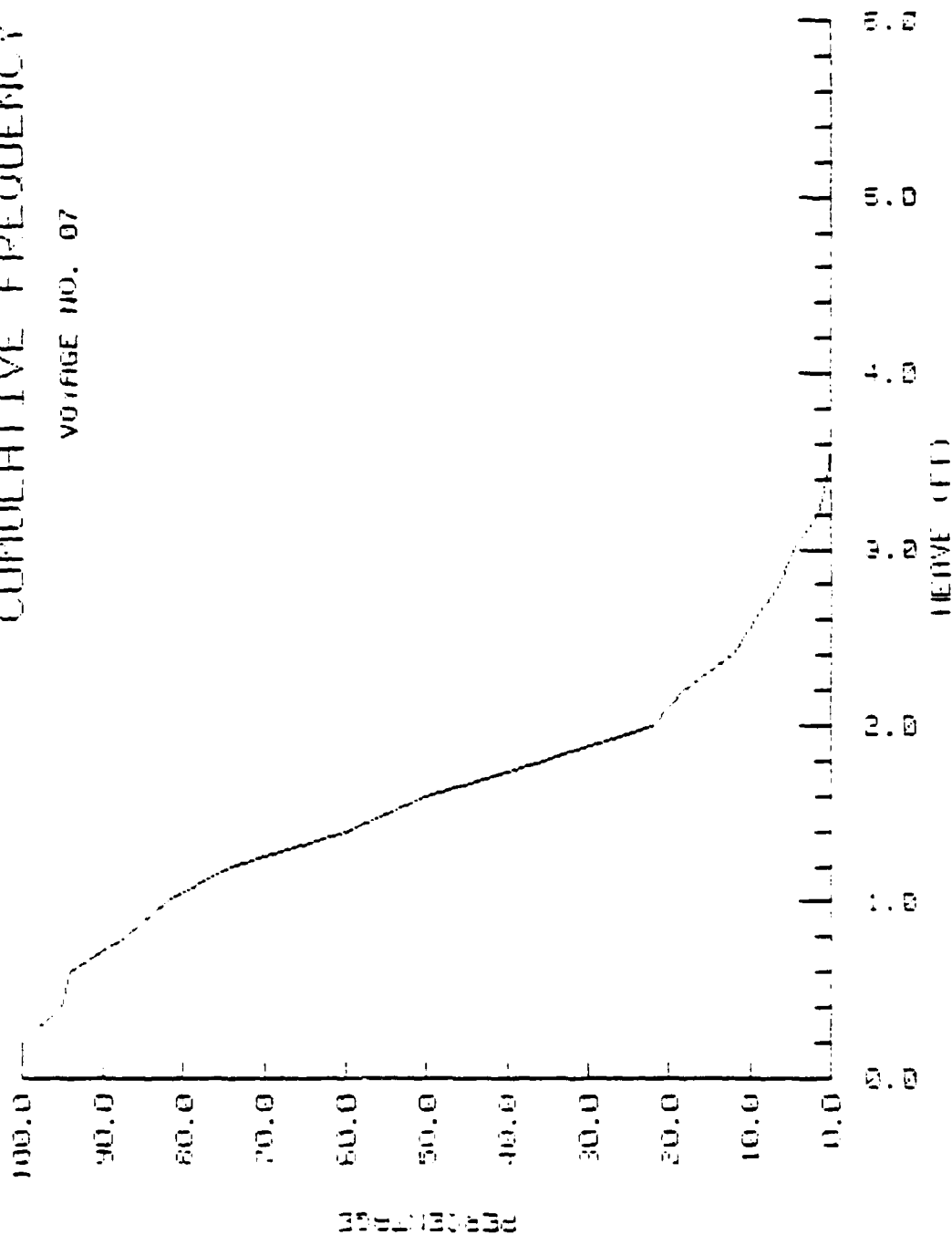
VOLTAGE NO. 07





# CUMULATIVE FREQUENCY

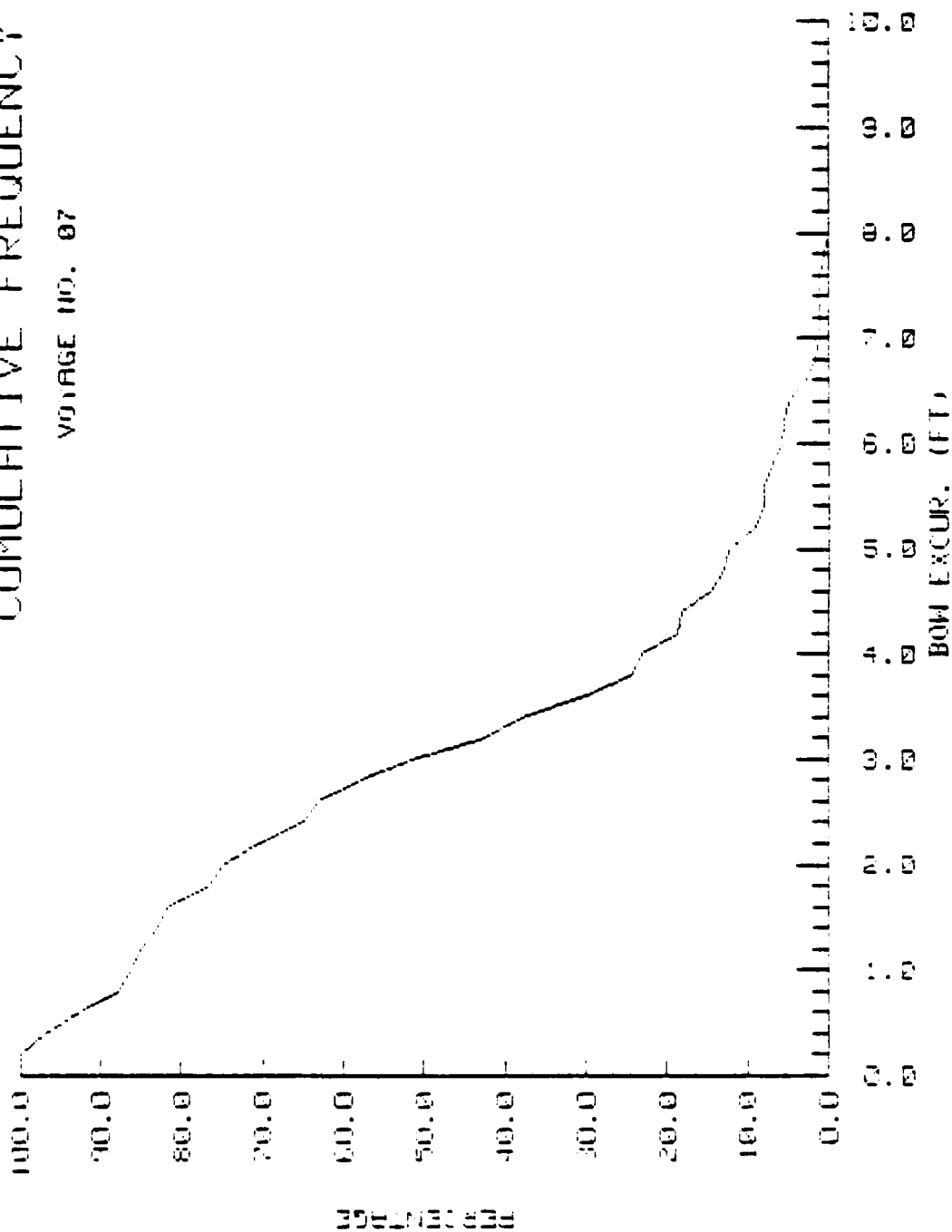
VOLTAIR NO. 07





# CUMULATIVE FREQUENCY

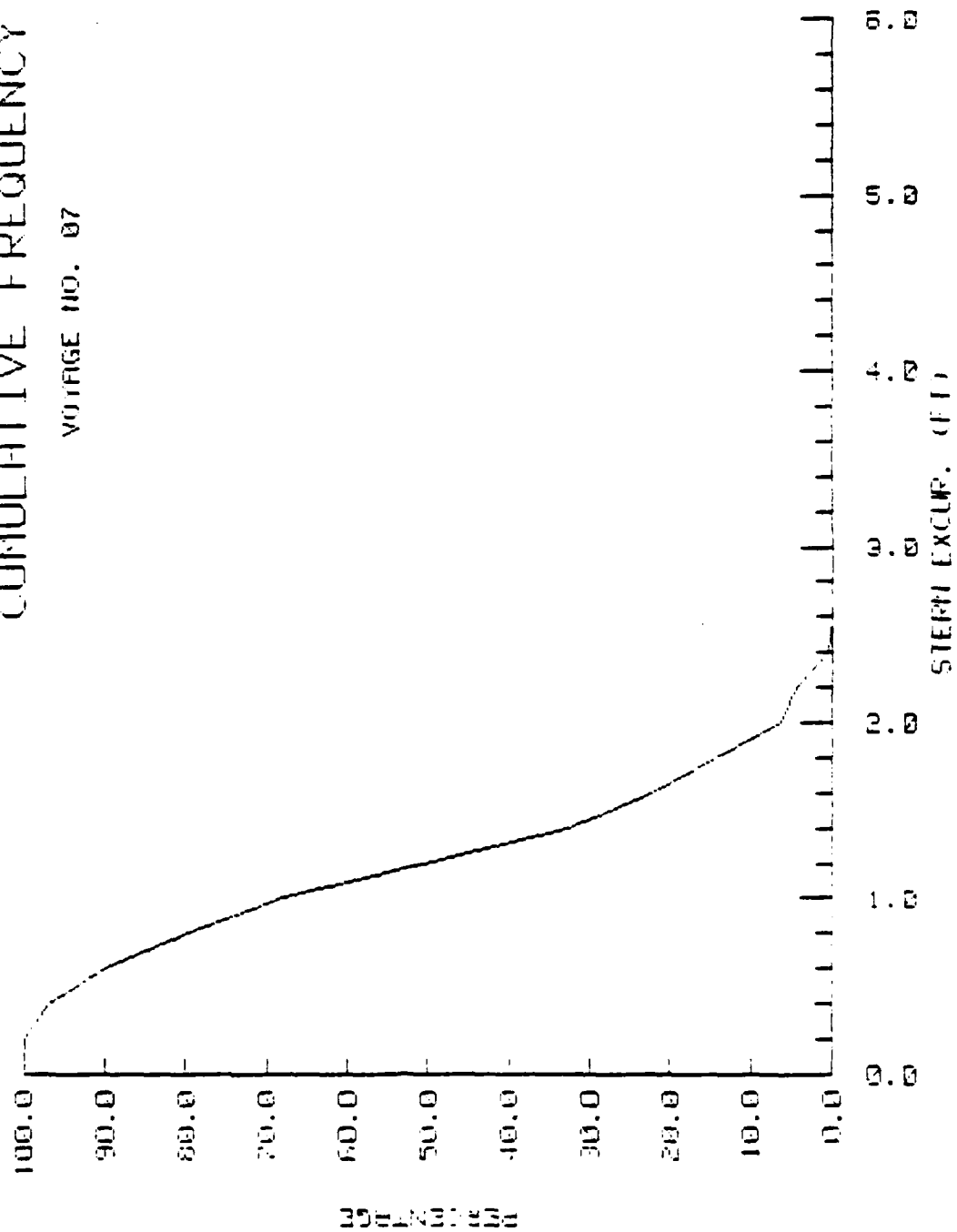
VOYAGE NO. 87





# CUMULATIVE FREQUENCY

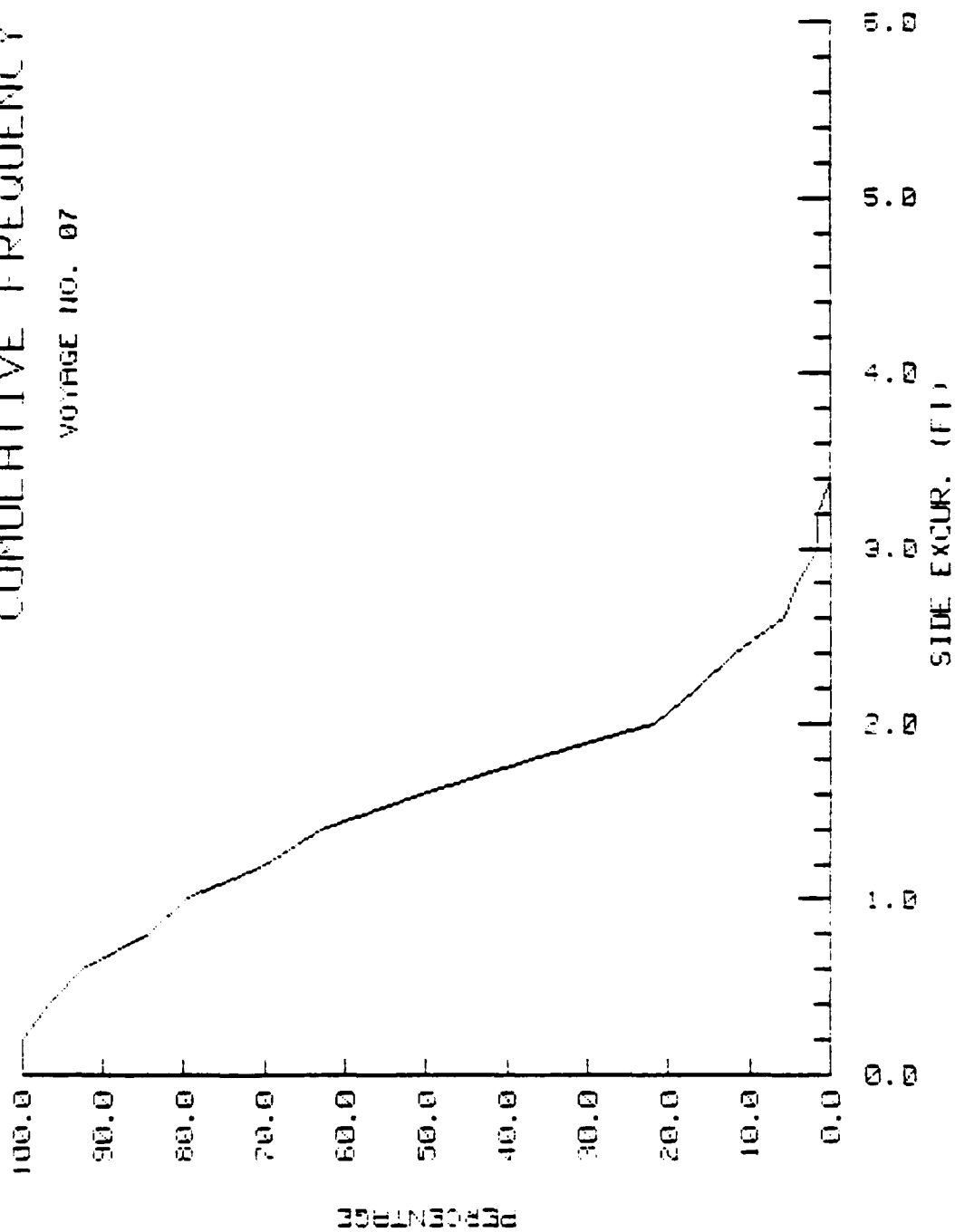
VOTAGE NO. 07





# CUMULATIVE FREQUENCY

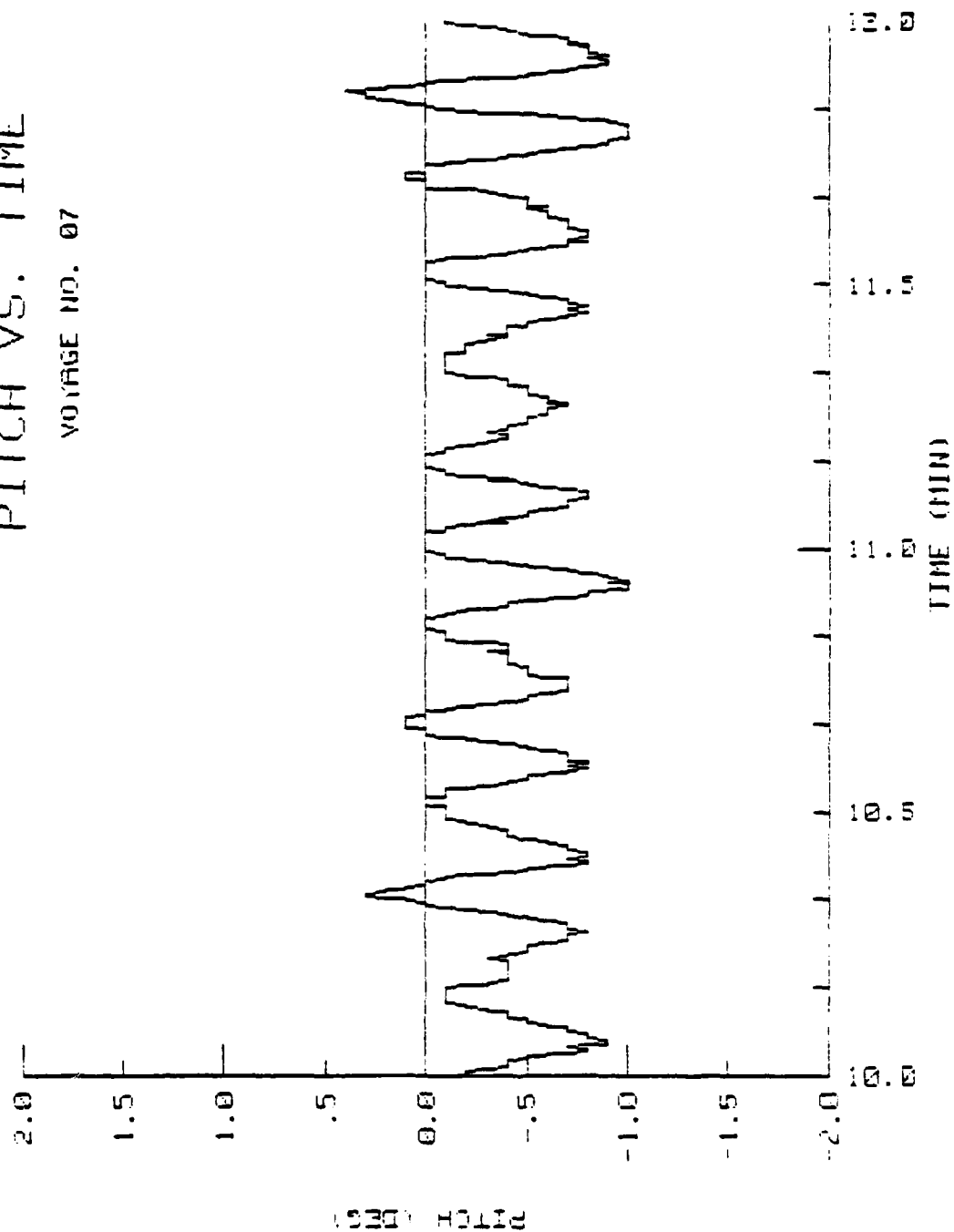
VOYAGE NO. 07





# PITCH VS. TIME

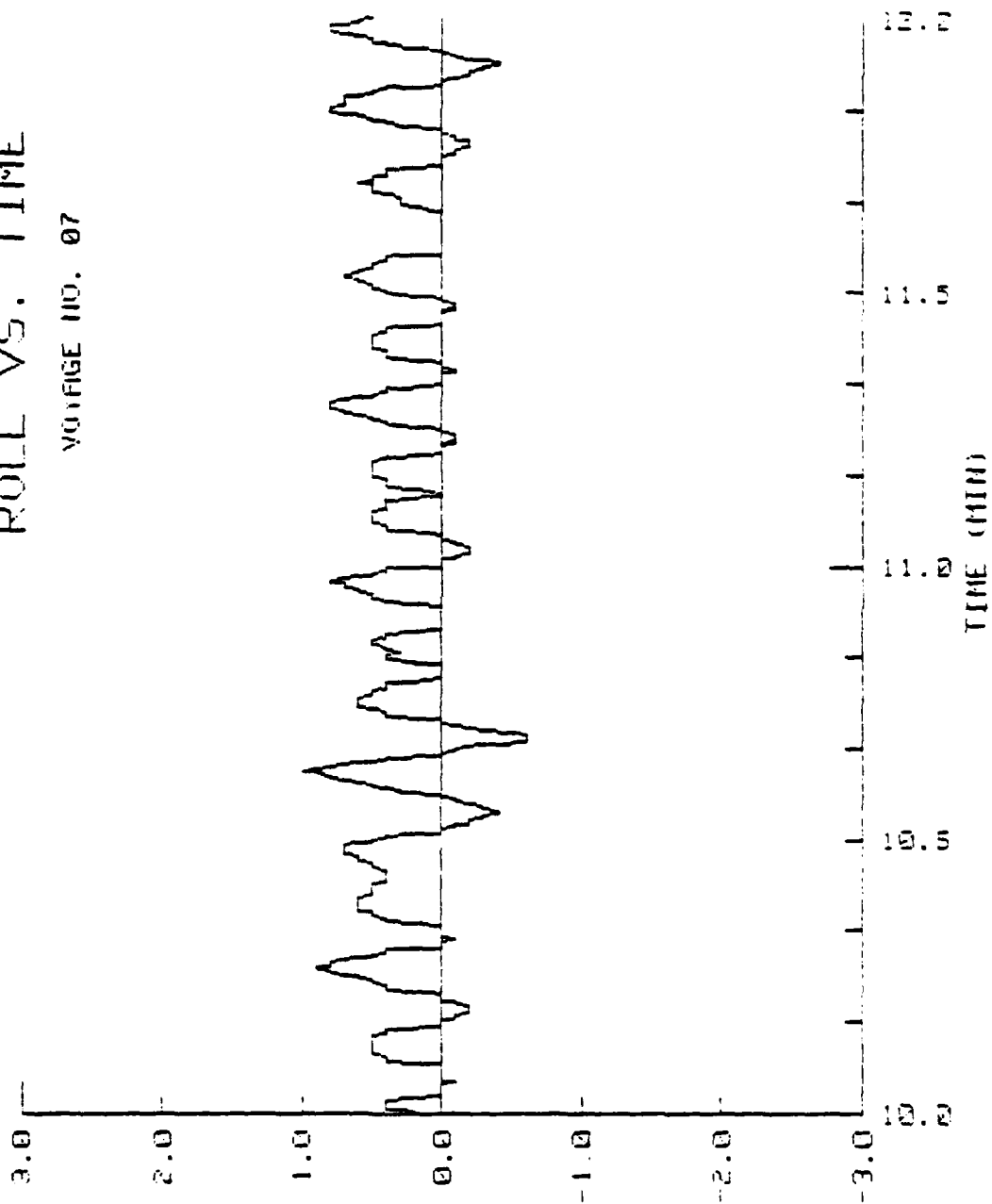
VOLTAJE NO. 07





# ROLL VS. TIME

VOYAGE NO. 07

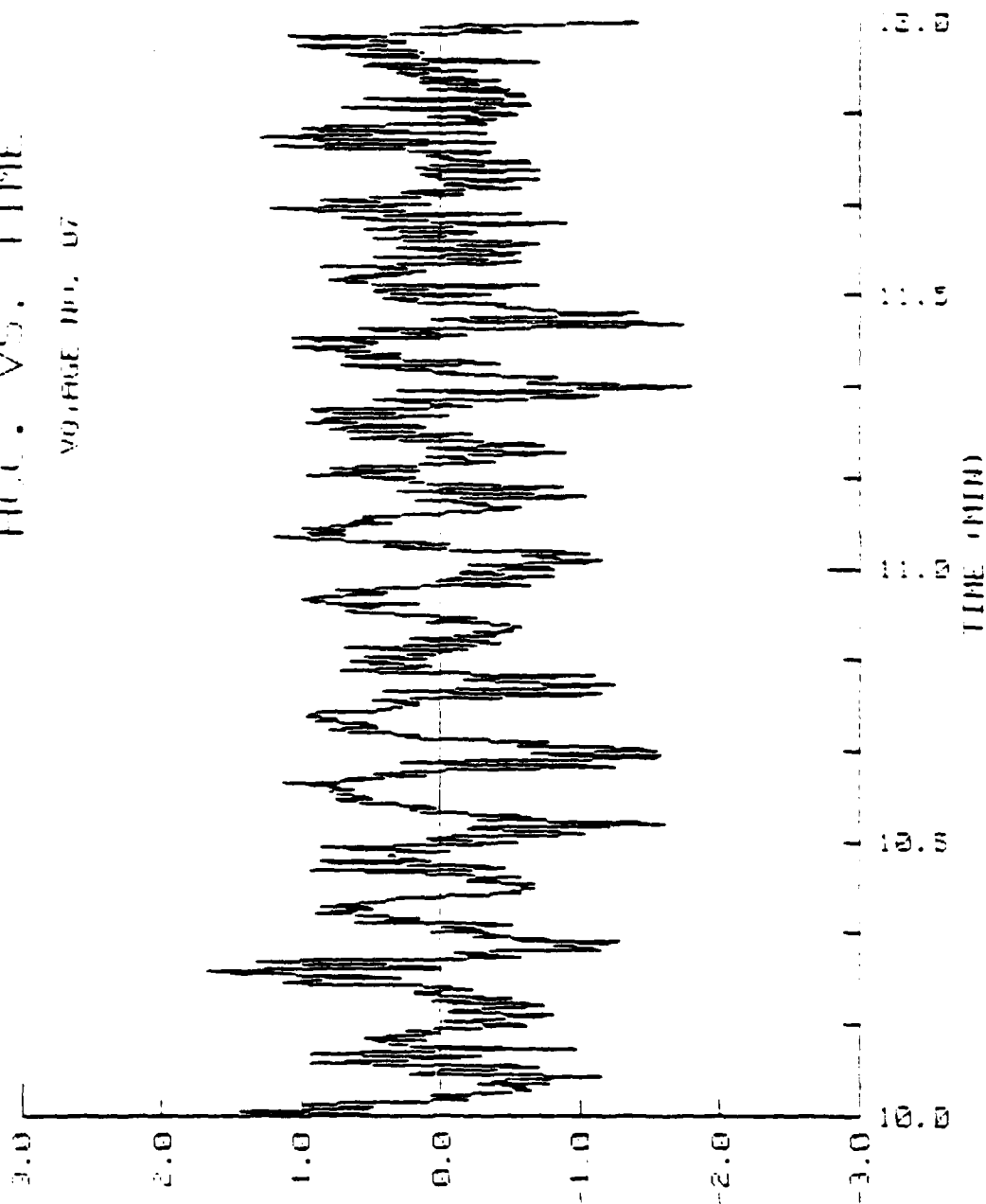


(930) 1705



ACC. VS. TIME

VOLUME 101, 07

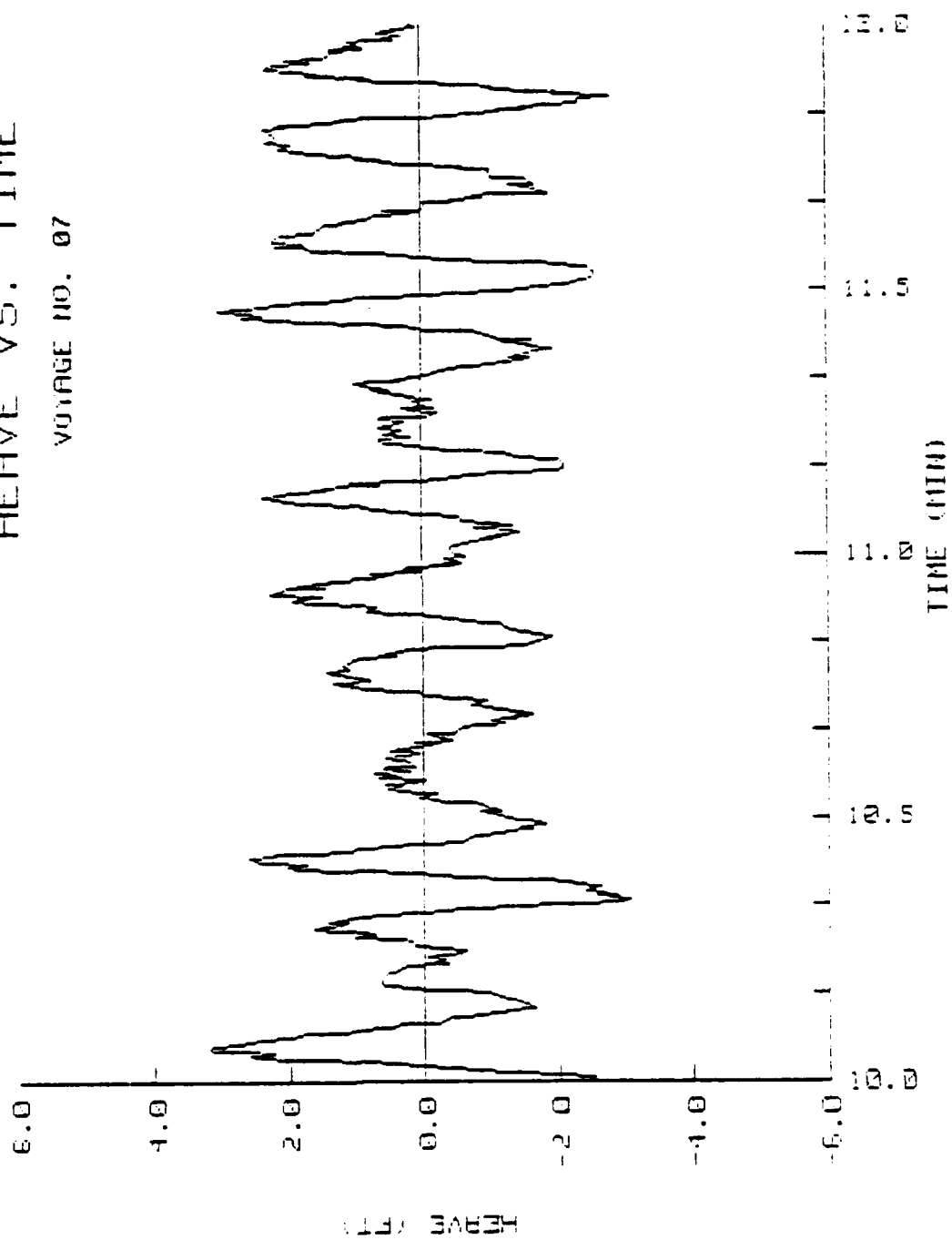


ACC. VS. TIME



# HEAVE VS. TIME

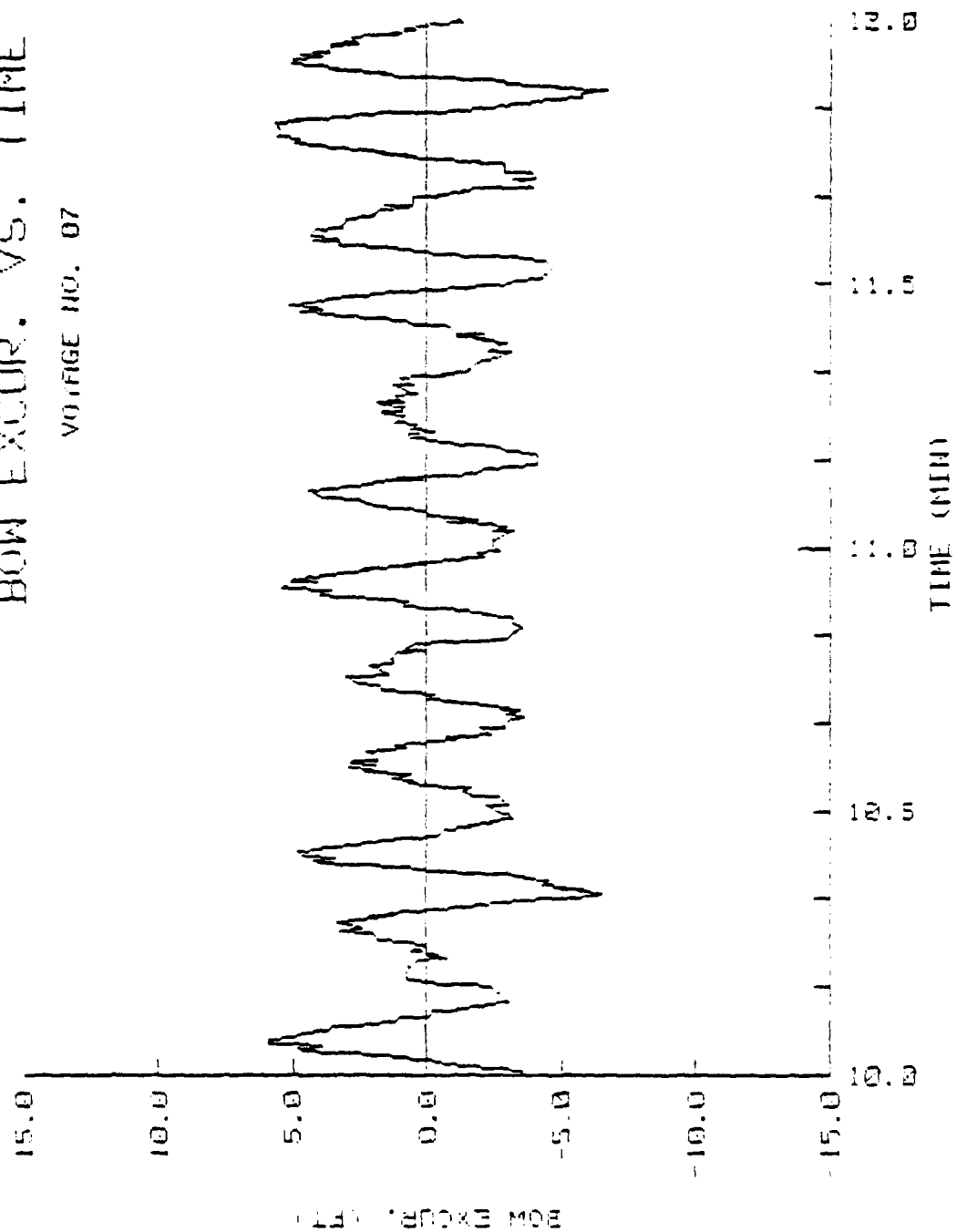
VOYAGE NO. 07





# BOW EXCUR. VS. TIME

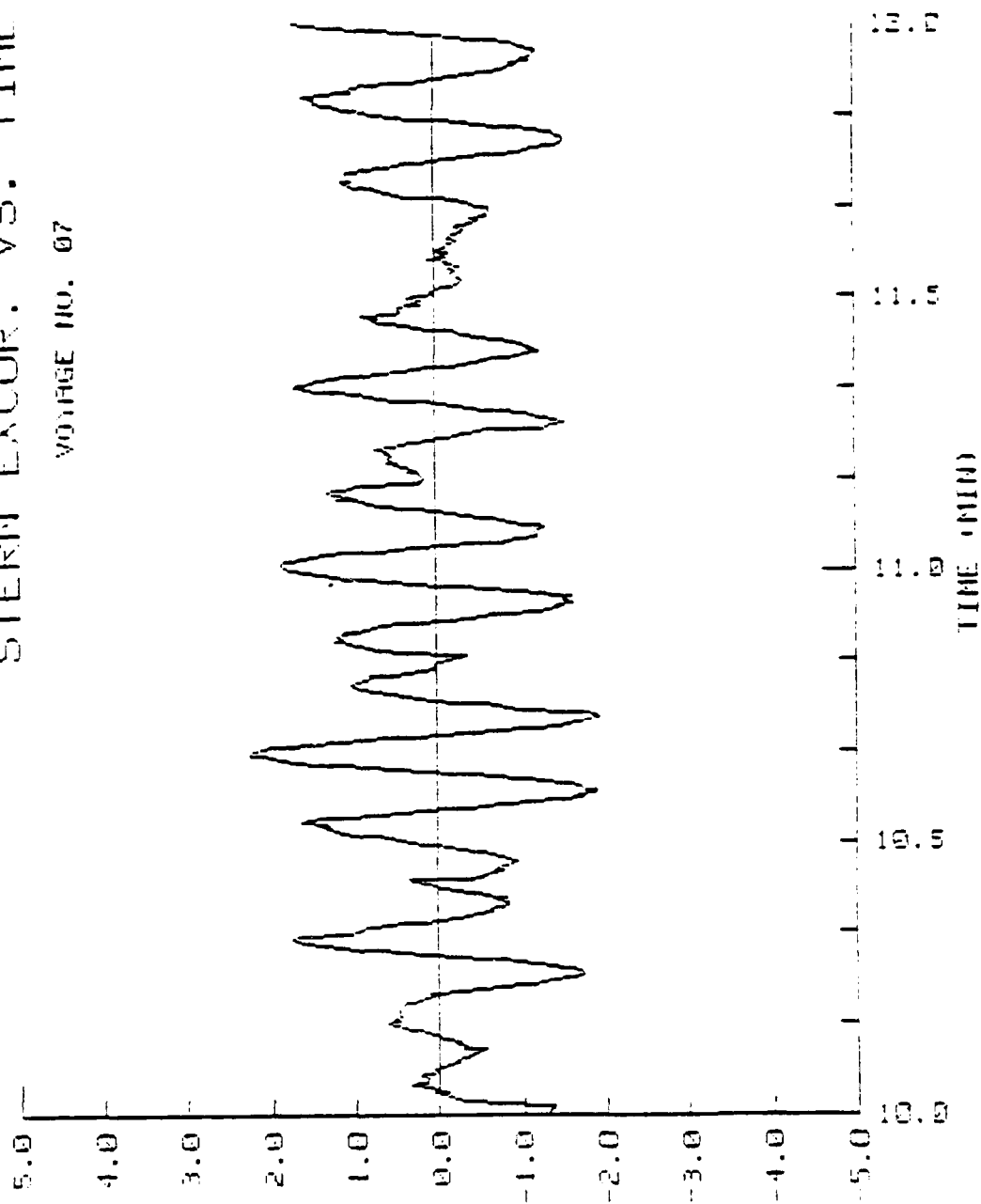
VOI FIGE NO. 07





# STERN EXCUR. VS. TIME

VOLUME NO. 07

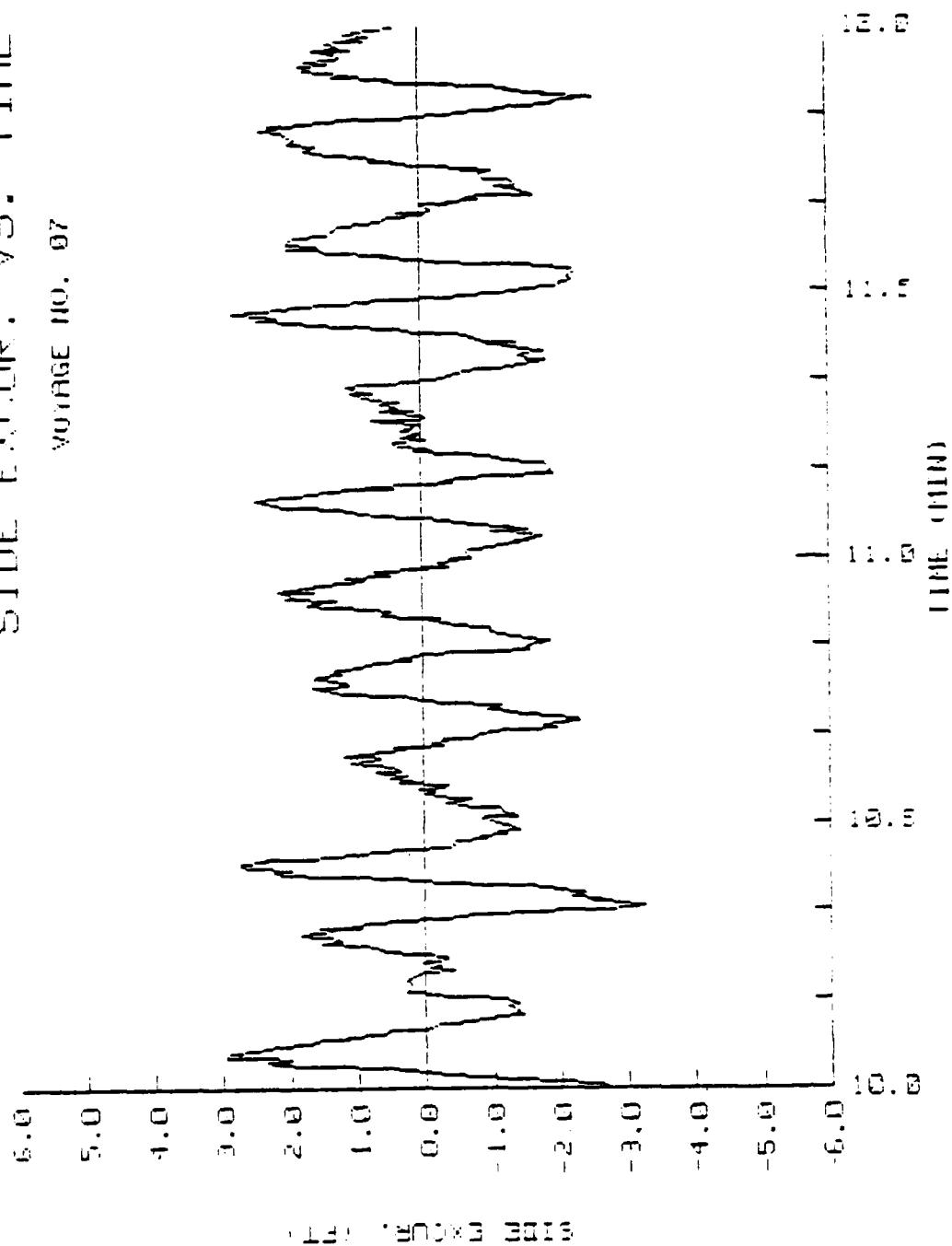


STERN EXCUR. (ST)



# SIDE EXCUR. VS. TIME

VOLTAGE NO. 07





# STATISTICAL SUMMARY

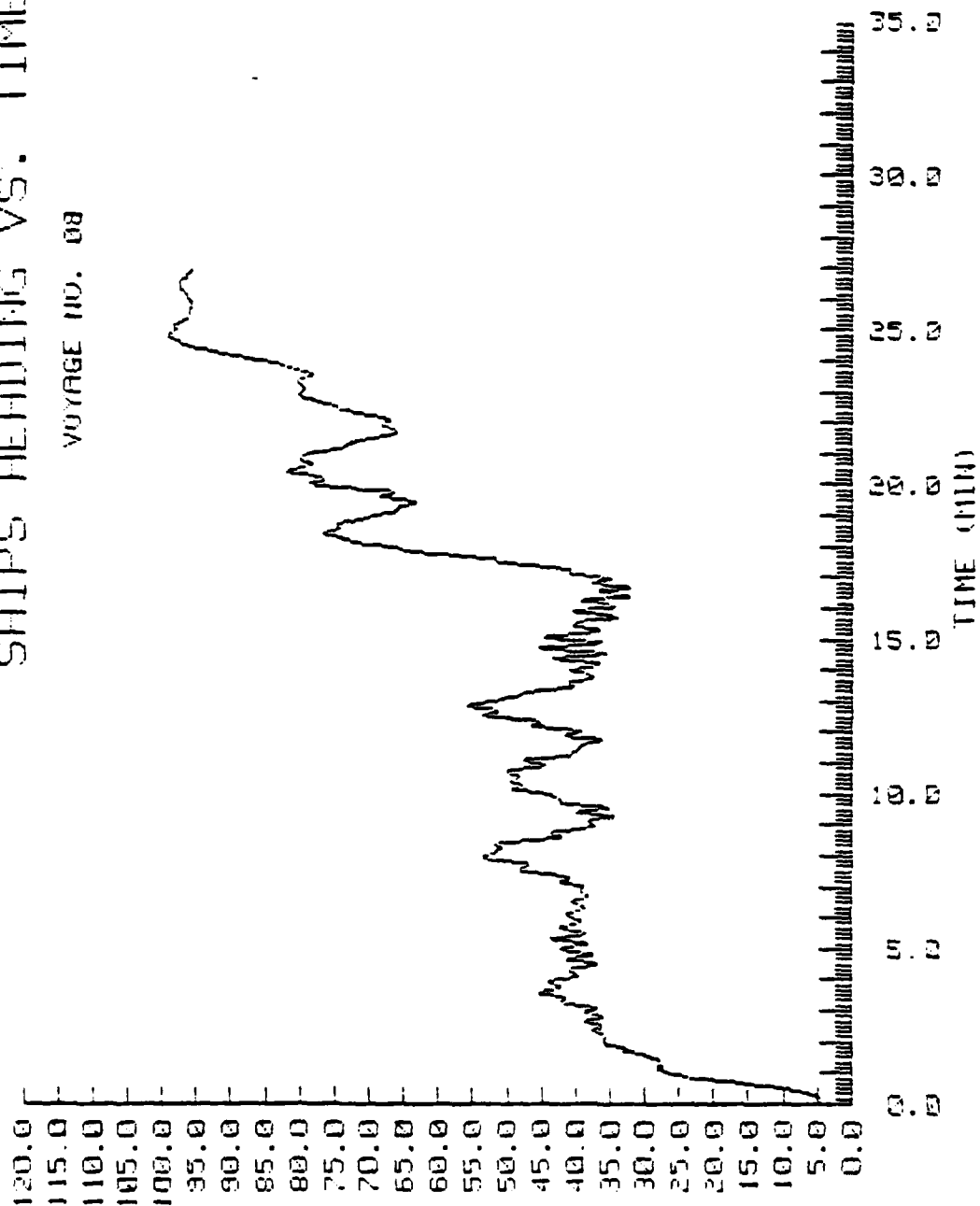
VOYAGE NO. 08

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	.3	2.3	.7	.8
ROLL (DEG)	.8	4.8	1.4	1.7
NOE (FT/SEC/SEC)	.0	2.1	.6	.7
HEAVE (FT)	.0	8.0	2.0	2.5
BOW EXCUR. (FT)	-.0	20.3	5.3	6.7
STERN EXCUR. (FT)	.0	6.4	1.8	2.2
SIDE EXCUR (FT)	.0	8.5	2.8	3.3



# SHIPS HEADING VS. TIME

VOYAGE NO. 08



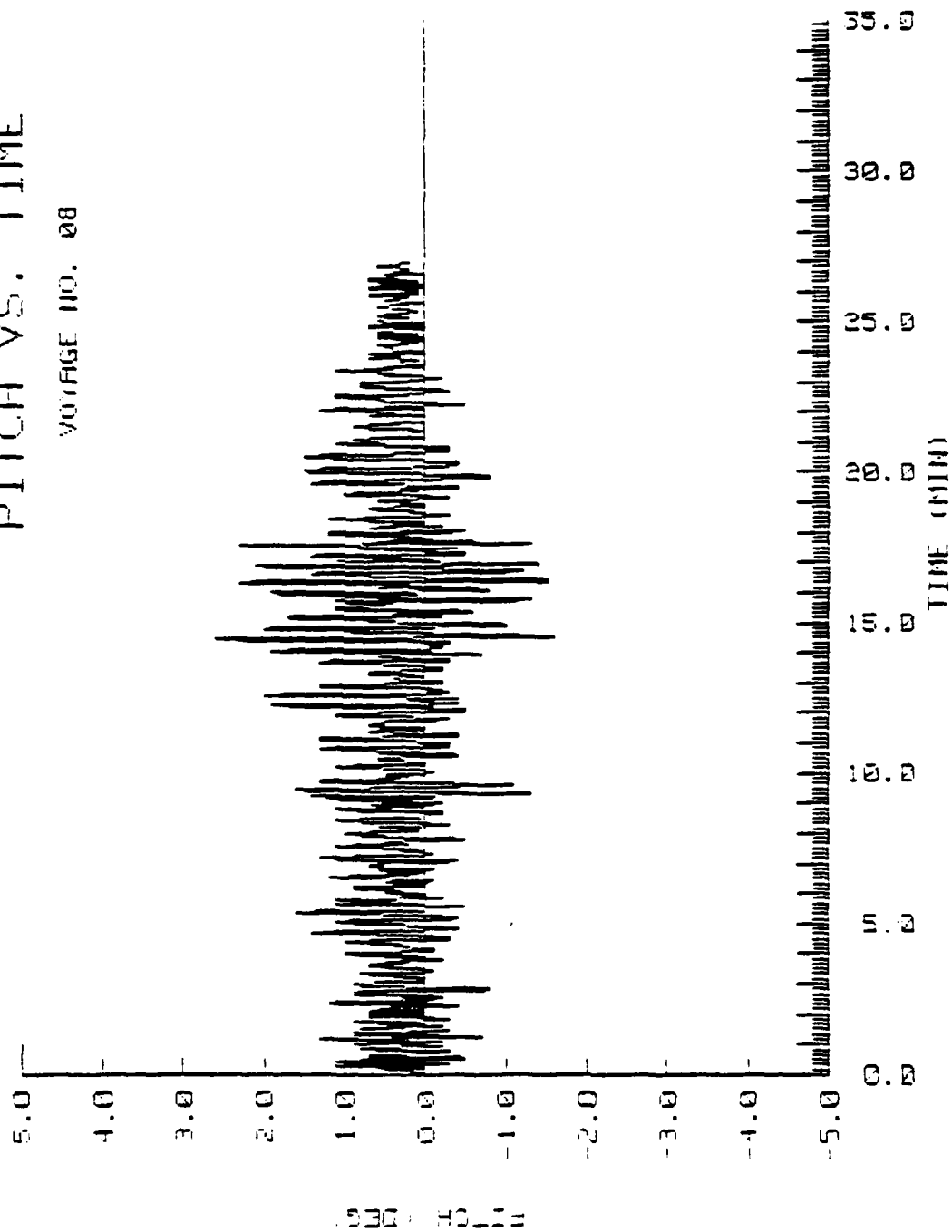
SHIPS HEADING (DEG)

TIME (MIN)



# PITCH VS. TIME

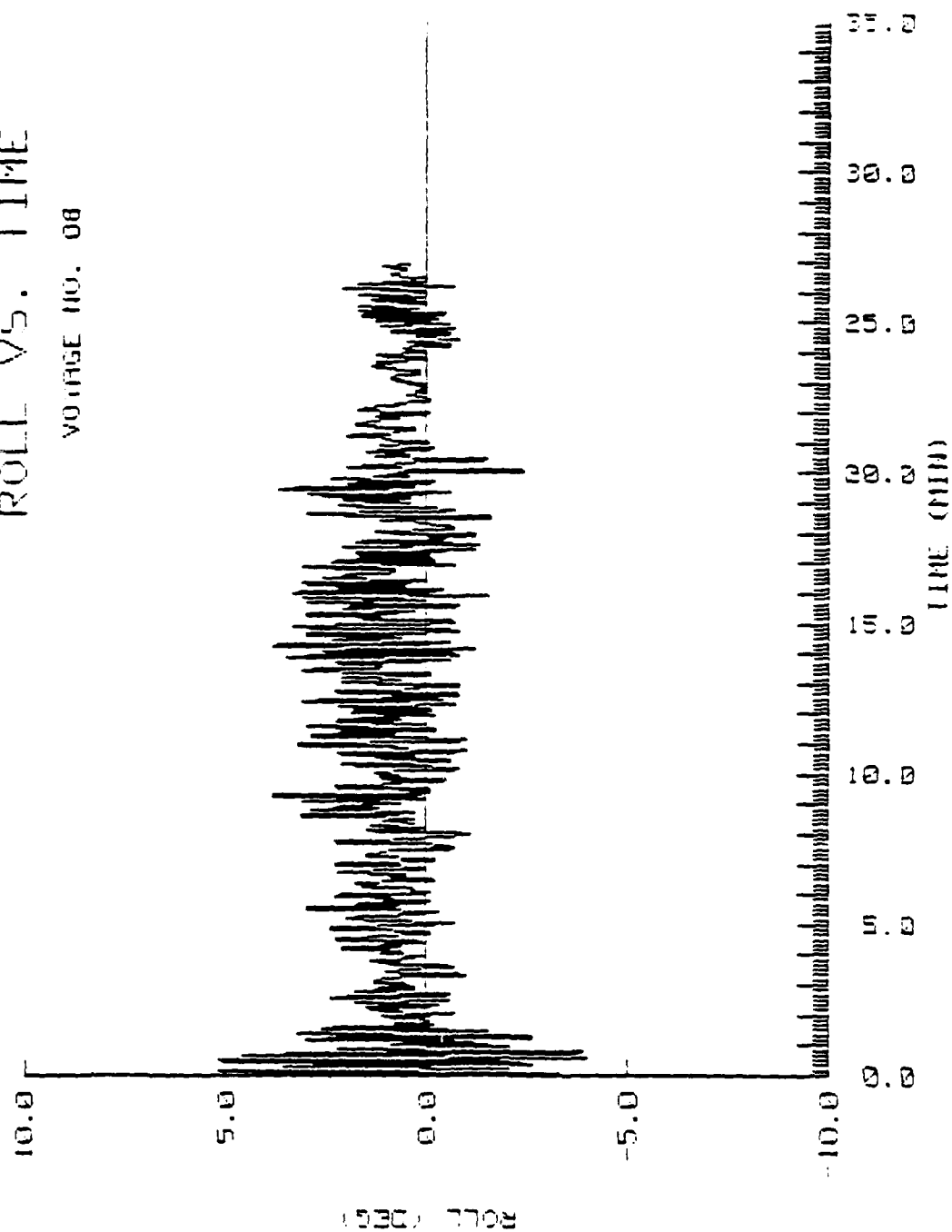
VOTAGE NO. 08





# ROLL V5. TIME

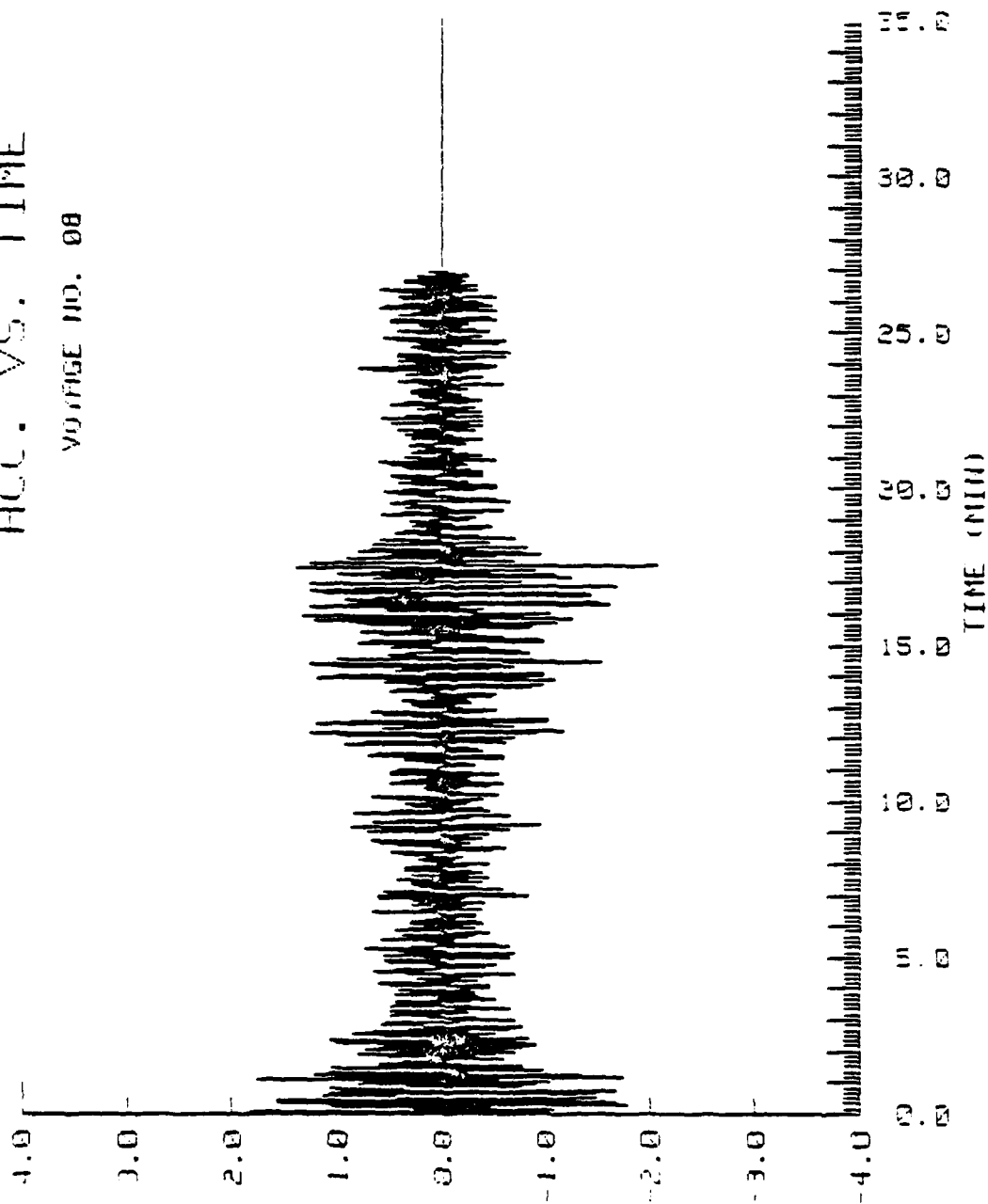
VORISE 110. 08





ACC. VS. TIME

VOYAGE NO. 00

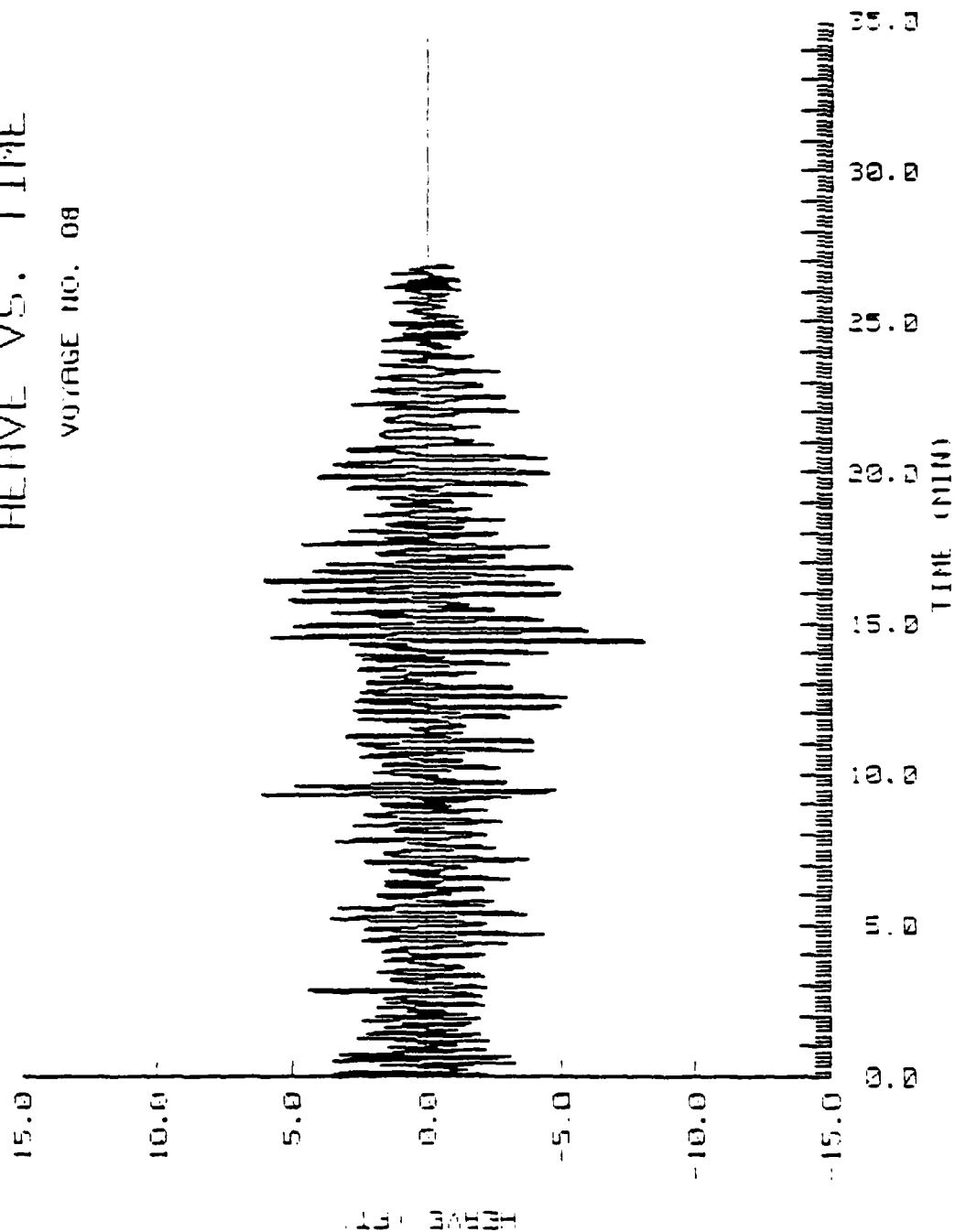


ACC. VS. TIME



# HEAVE VS. TIME

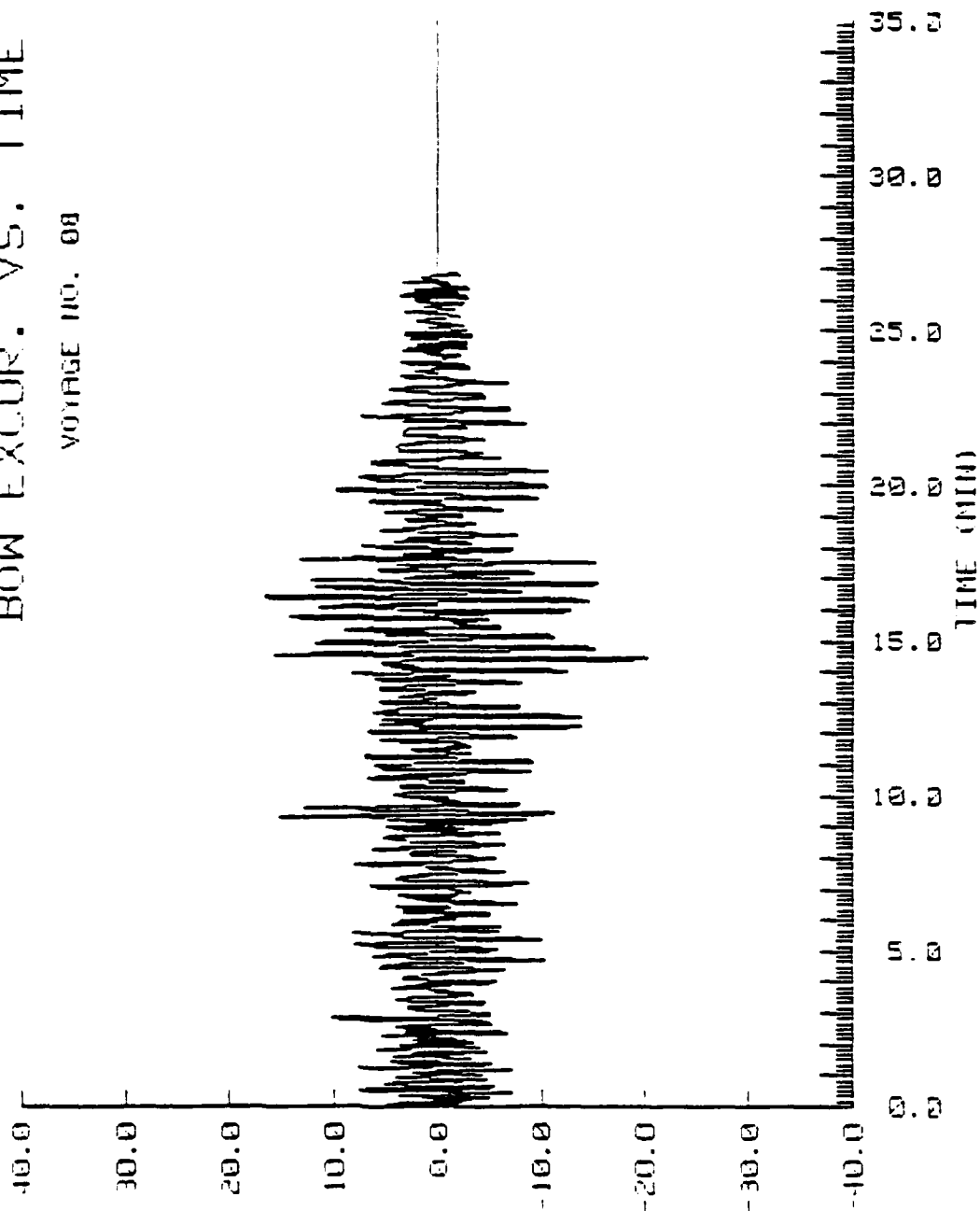
VOLTAJE NO. 08





# BOW EXCUR. VS. TIME

VOLTAGE NO. 08

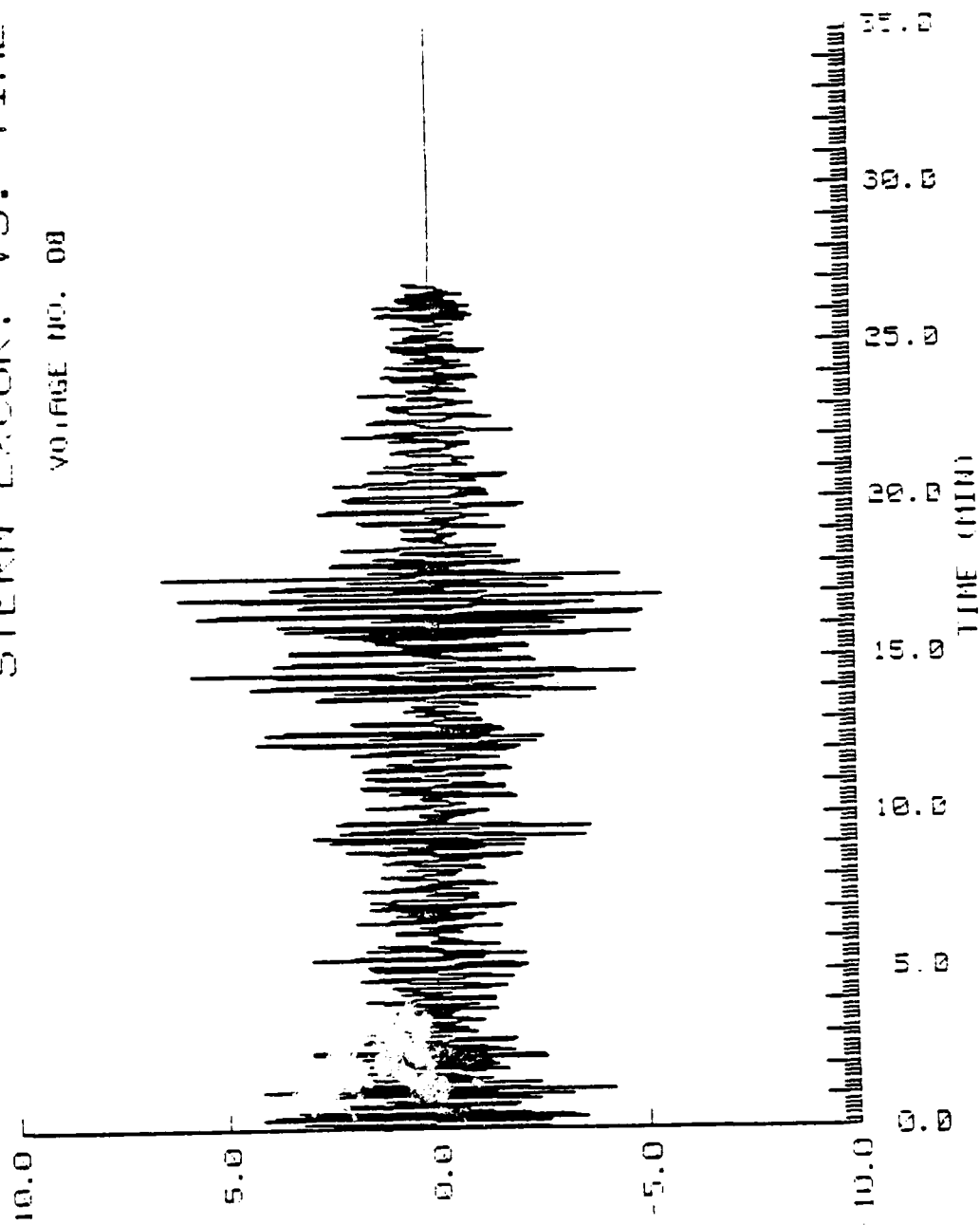


BOW EXCUR. - 71



# STERN EXCUR. VS. TIME

VOICE NO. 08

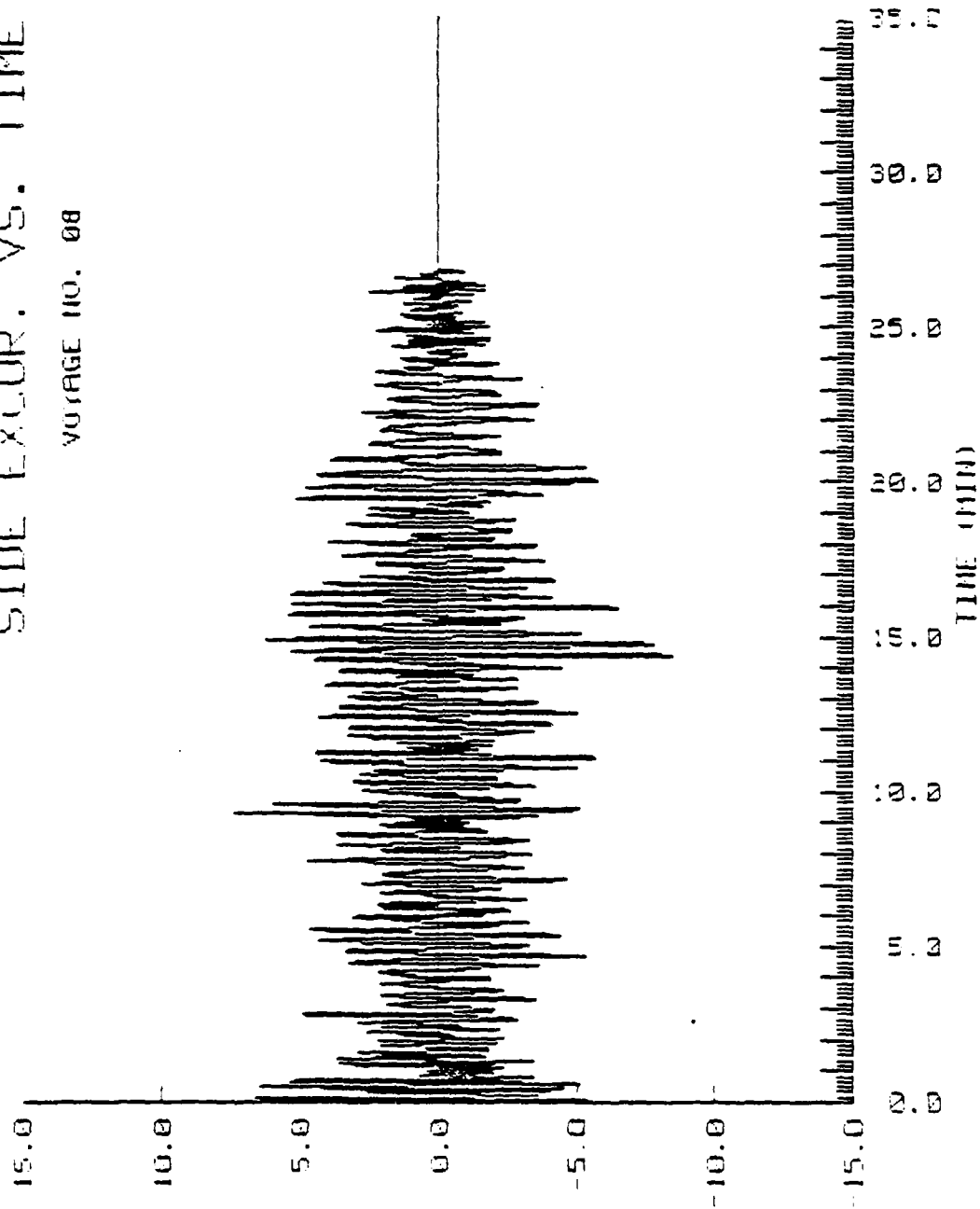


STERN EXCUR. (FT)



# SIDE EXCUR. VS. TIME

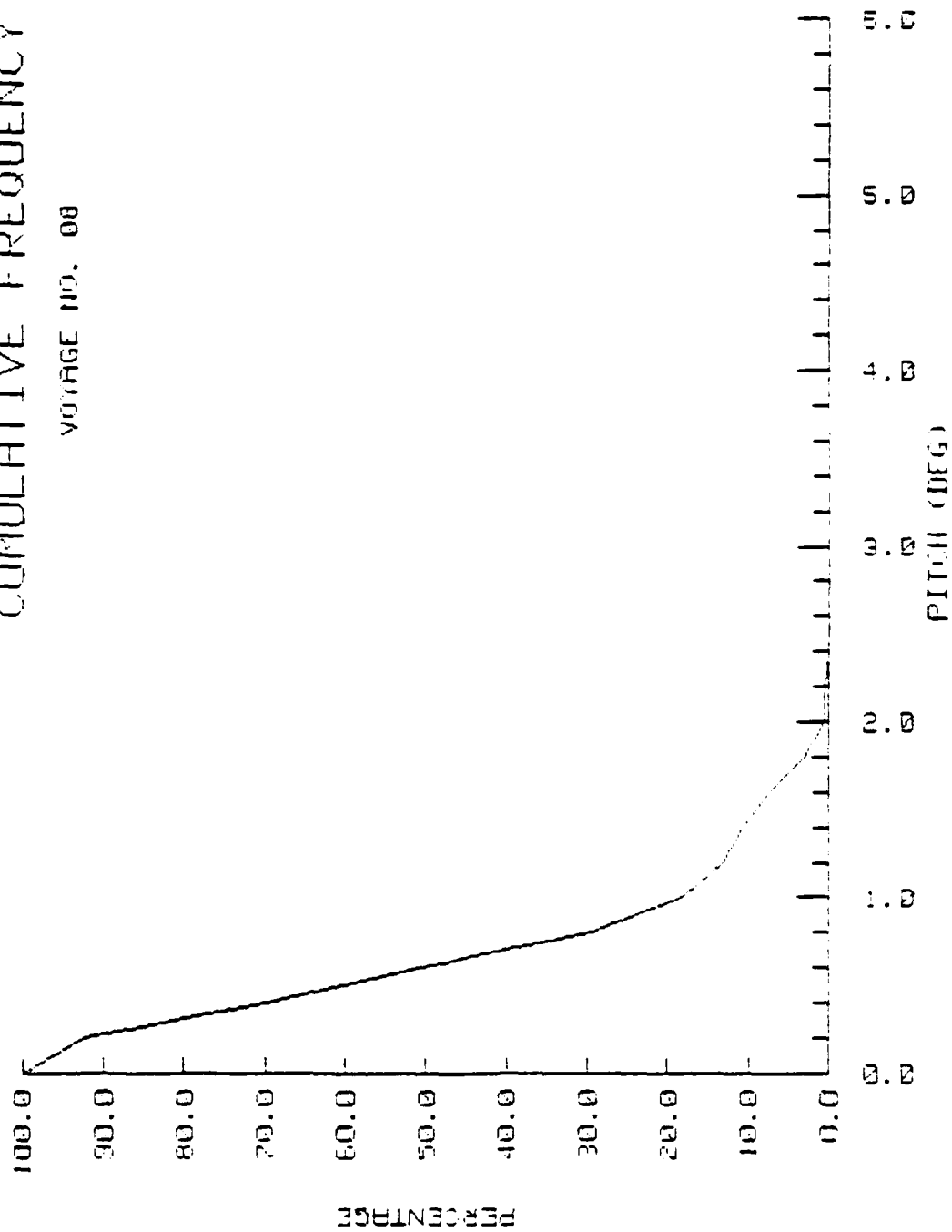
VORAGE 110. 08





# CUMULATIVE FREQUENCY

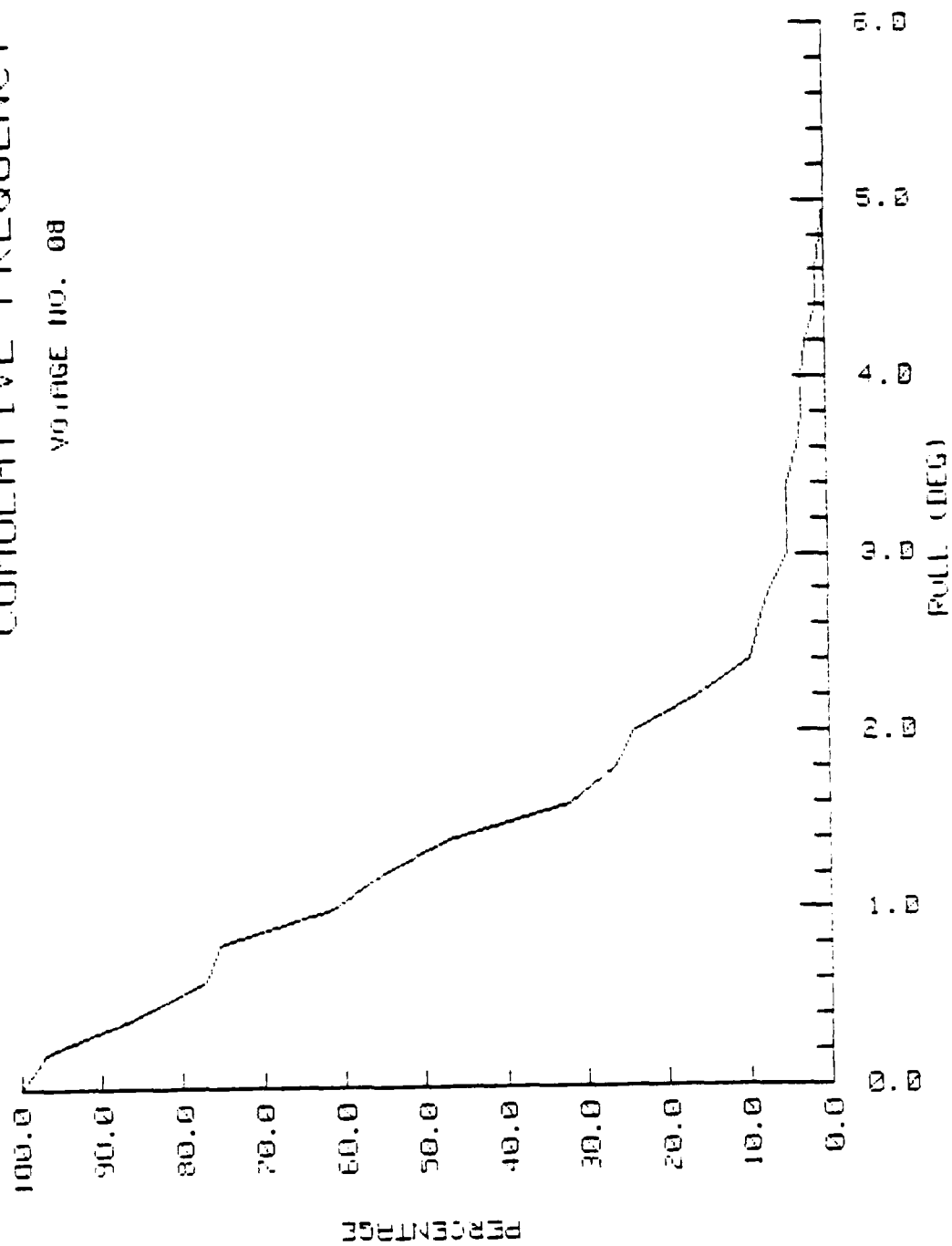
VOLTAGE NO. 08





# CUMULATIVE FREQUENCY

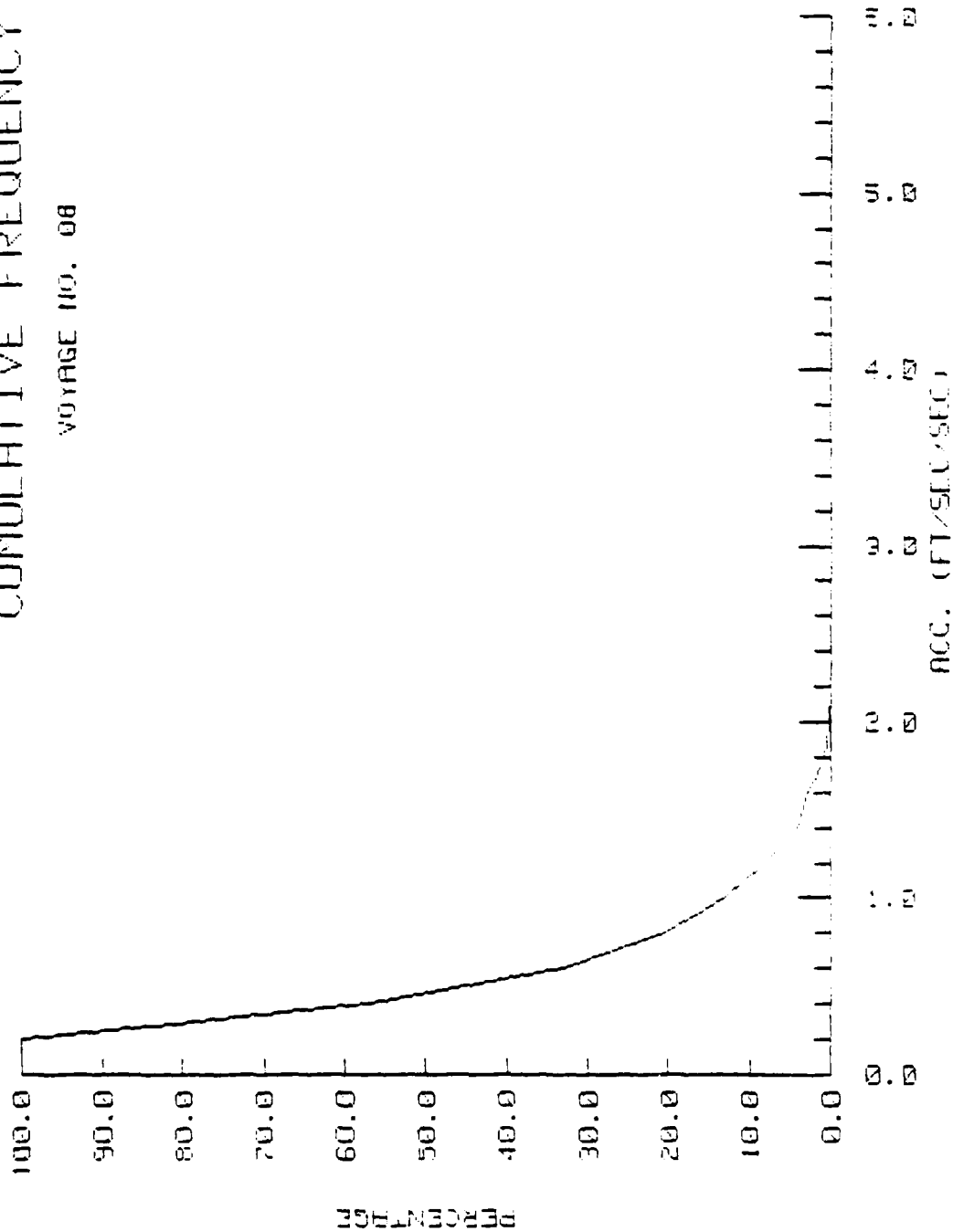
VOLTAGGE 110. 08





# CUMULATIVE FREQUENCY

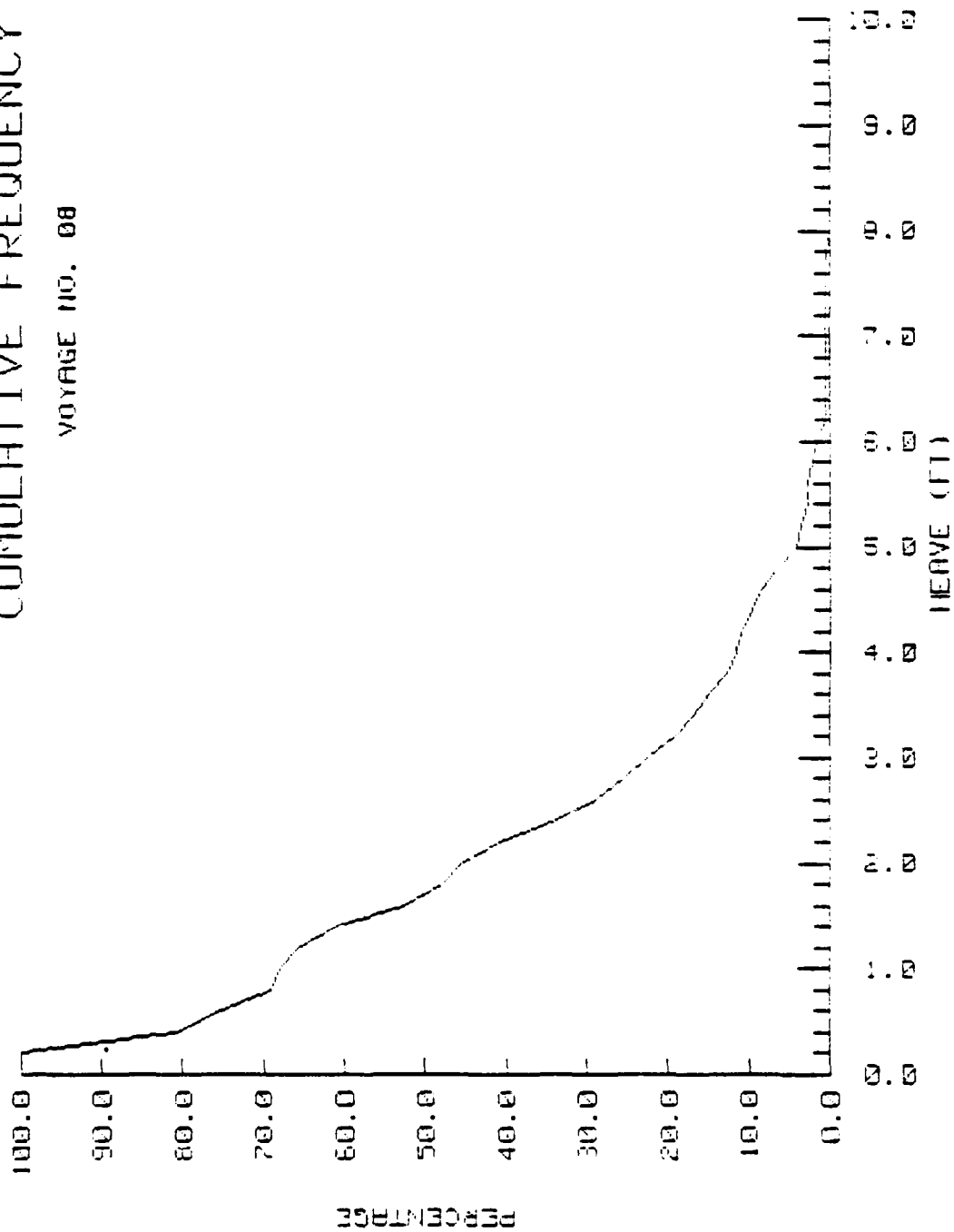
VOYAGE NO. 08





# CUMULATIVE FREQUENCY

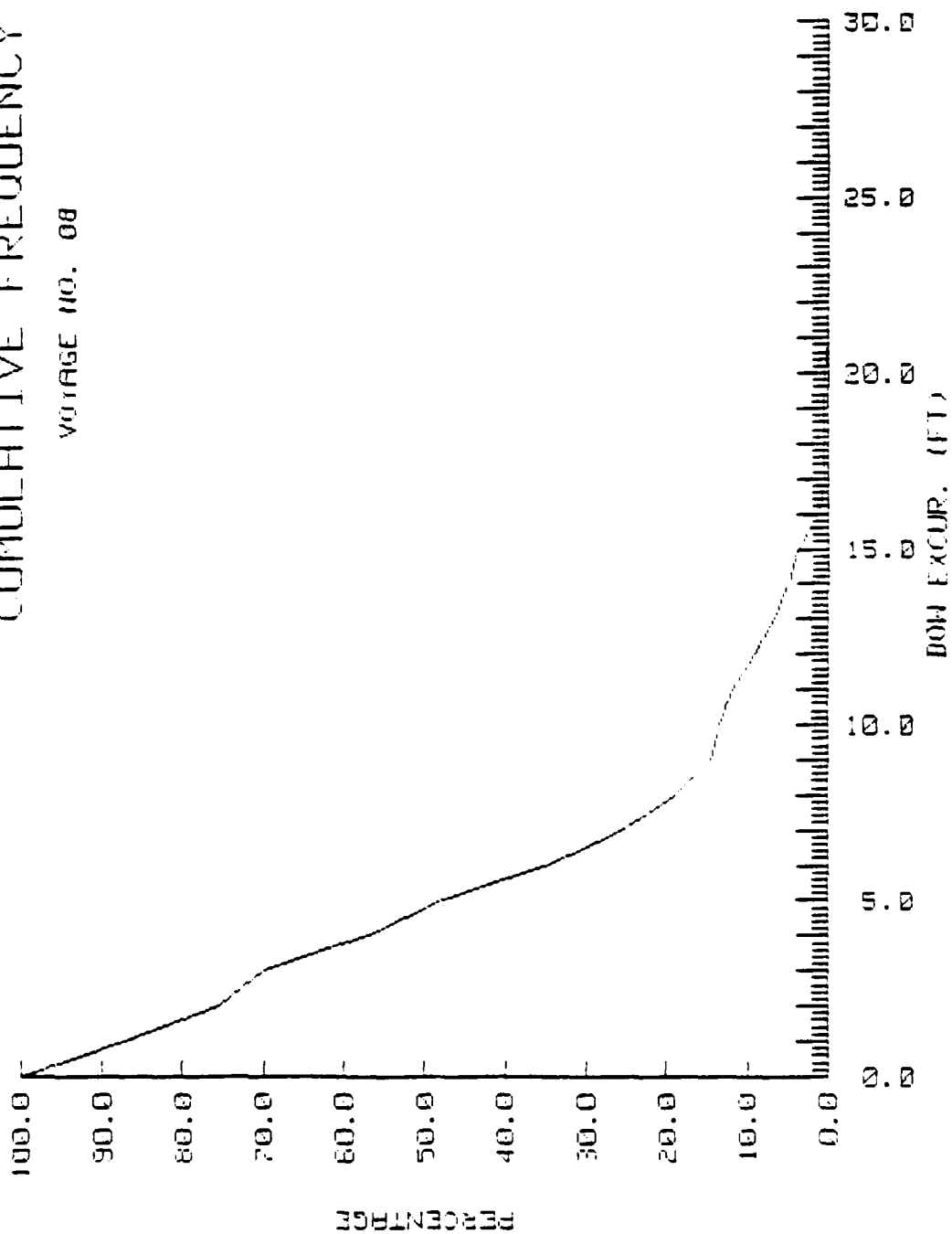
VOYAGE NO. 08





# CUMULATIVE FREQUENCY

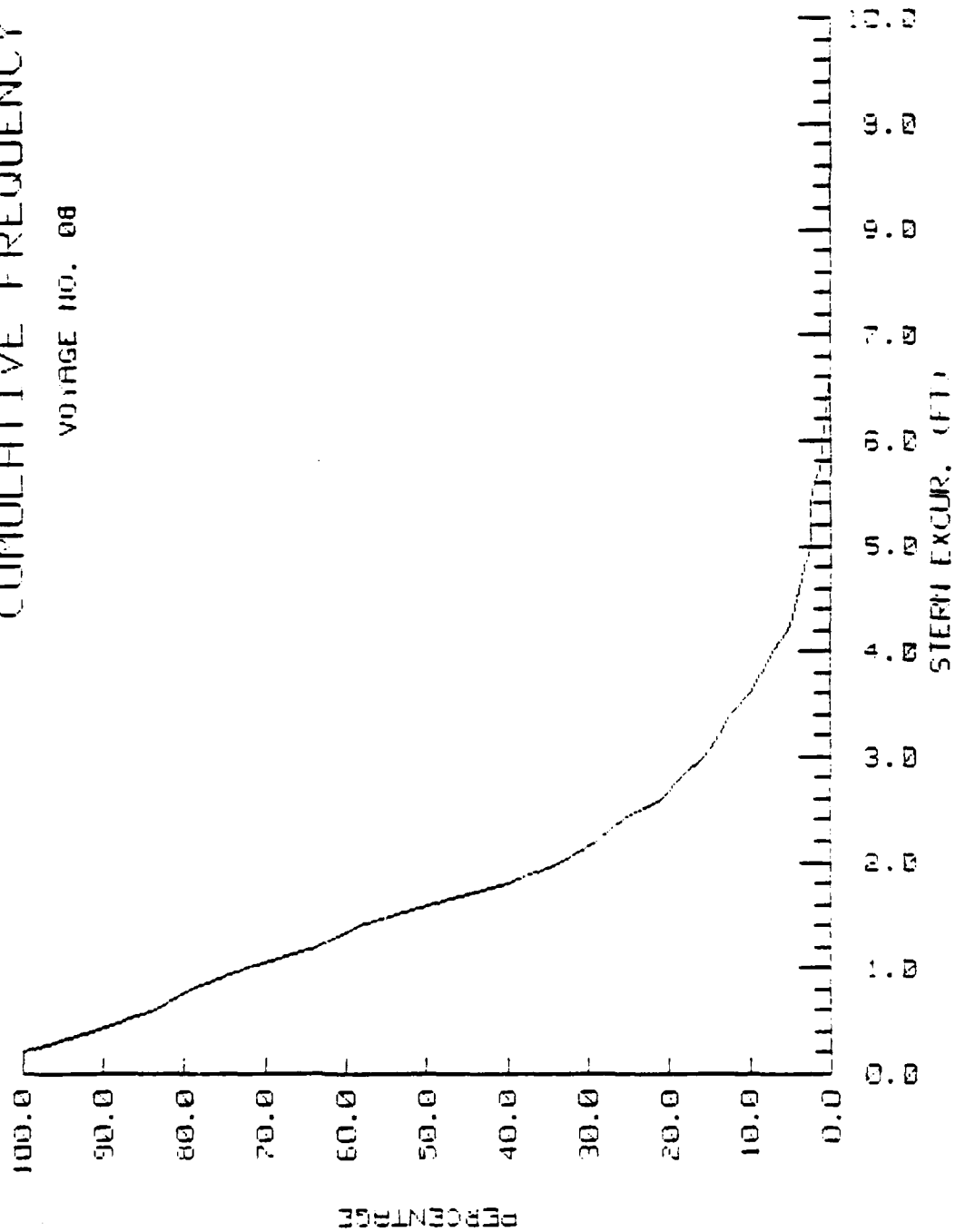
VOTAGE NO. 08





# CUMULATIVE FREQUENCY

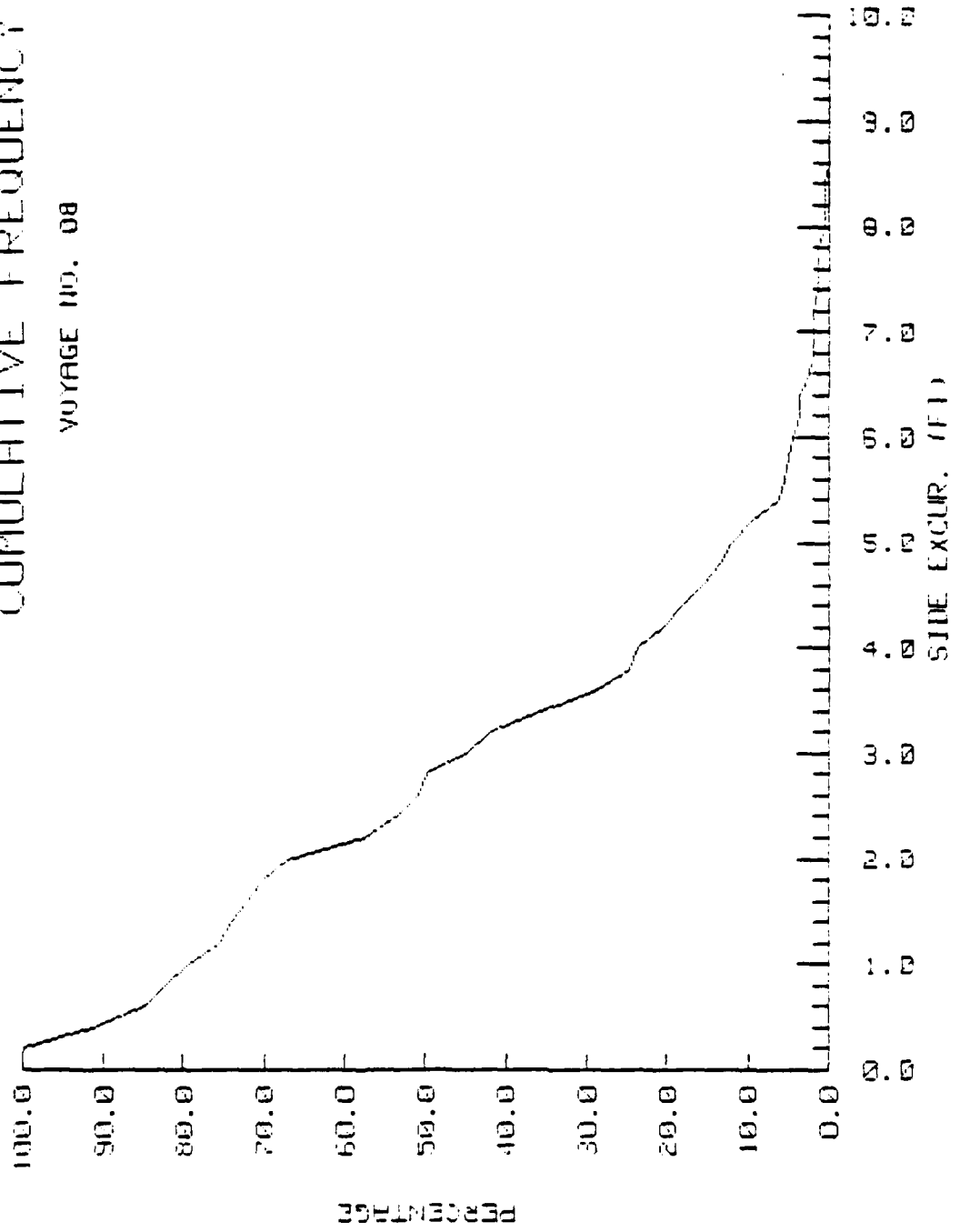
VOYAGE NO. 08





# CUMULATIVE FREQUENCY

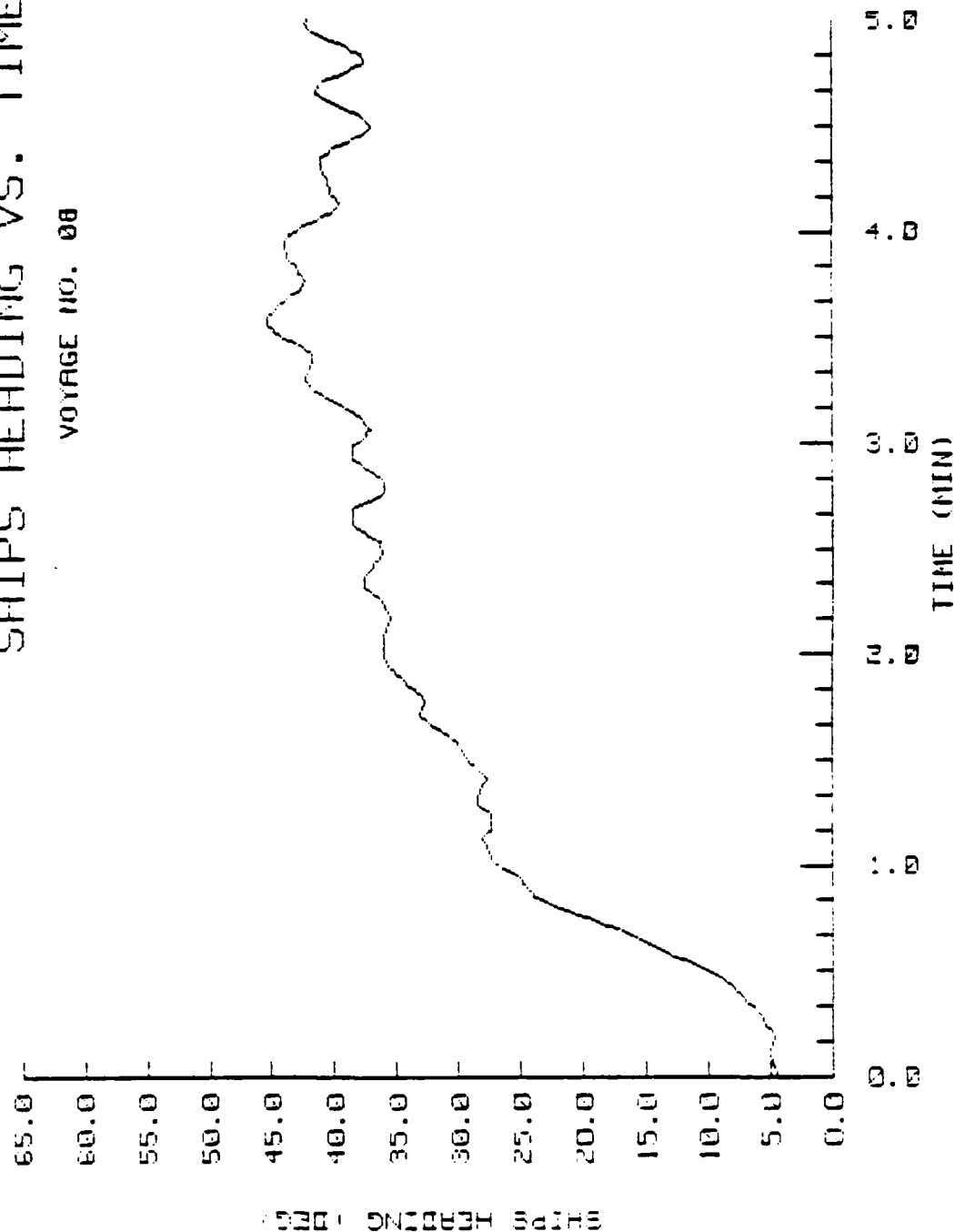
VOYAGE NO. 08





# SHIPS HEADING VS. TIME

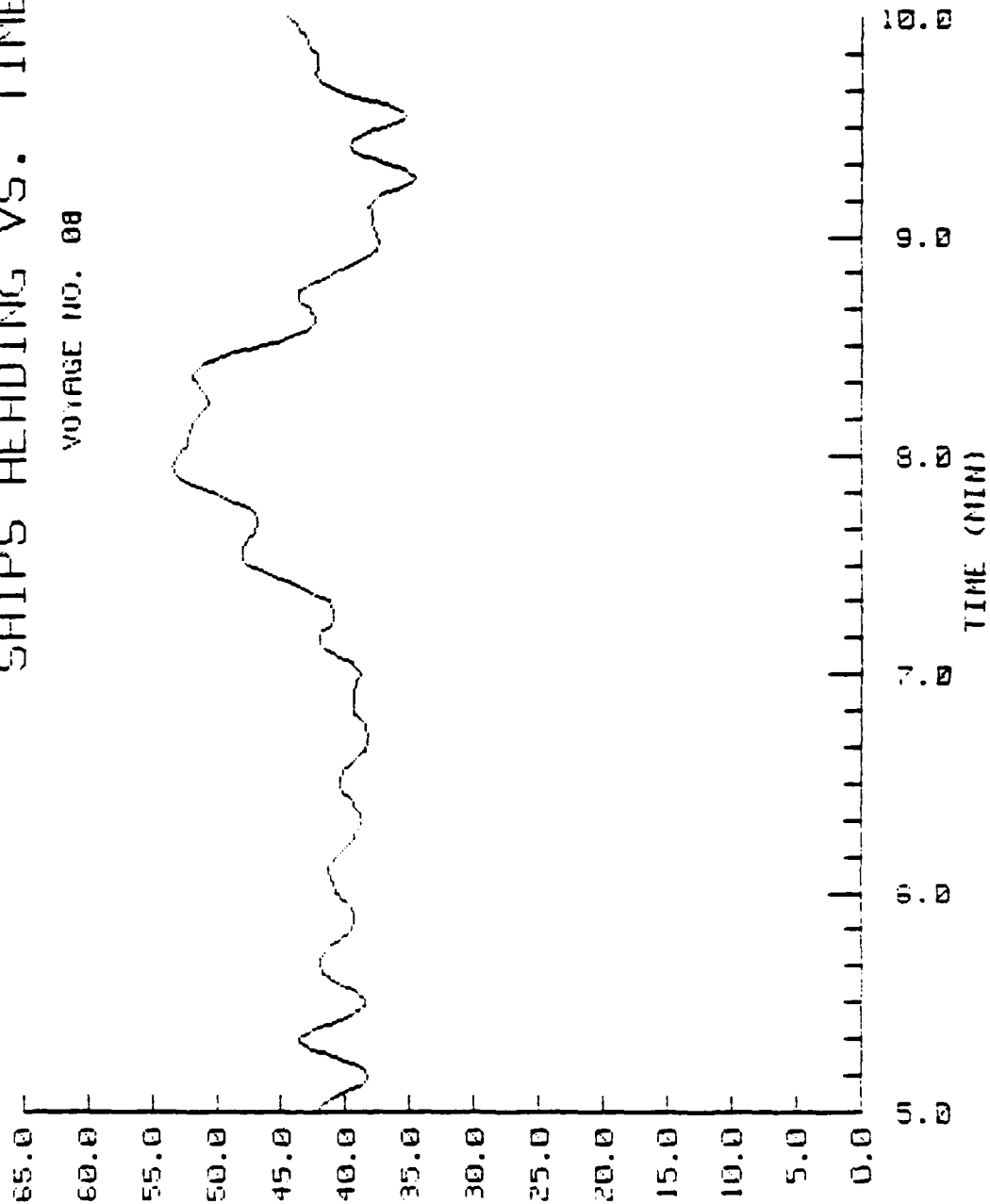
VOYAGE NO. 08





# SHIPS HEADING VS. TIME

VOYAGE NO. 08

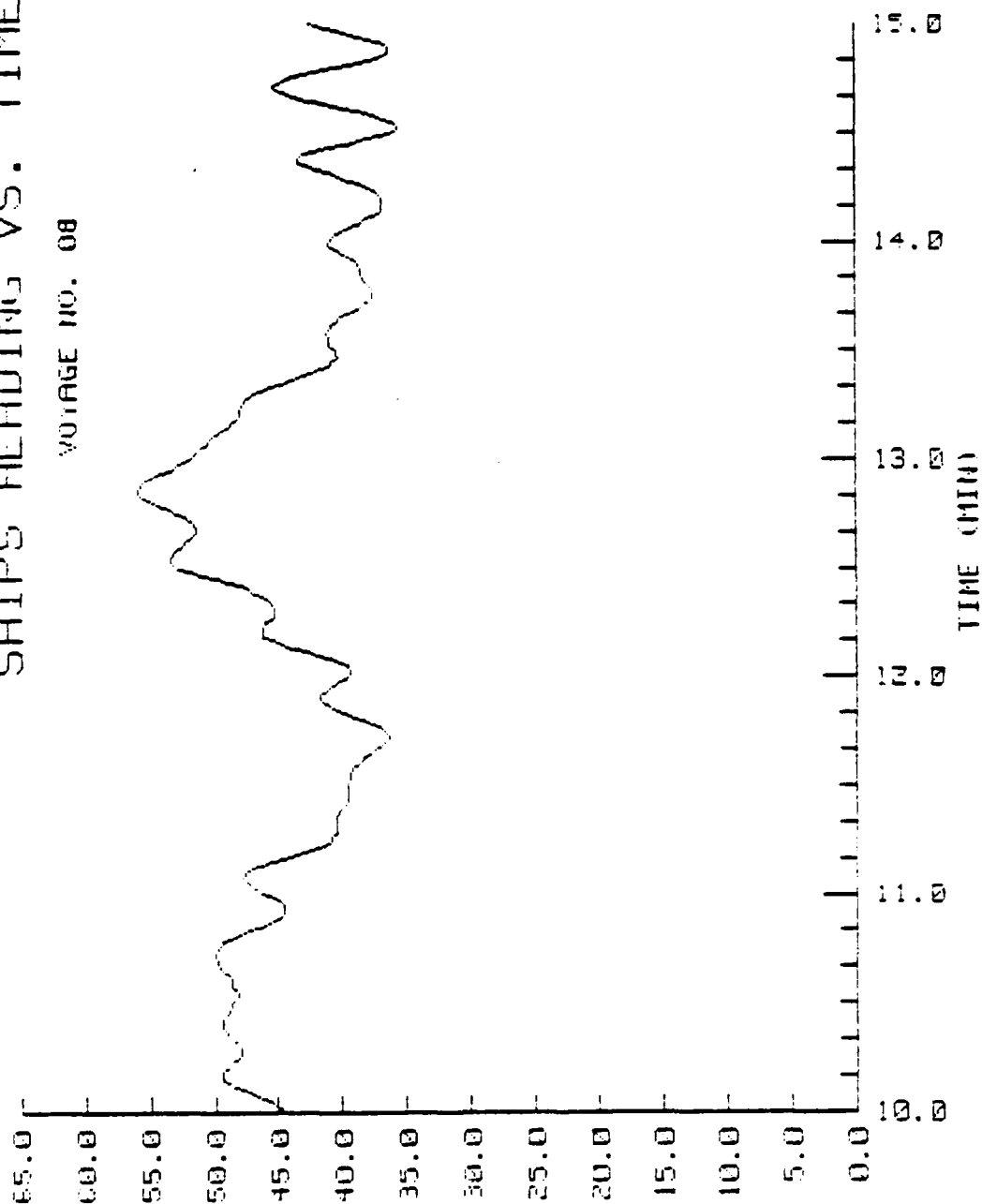


0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00



# SHIPS HEADING VS. TIME

VOTAGE NO. 08

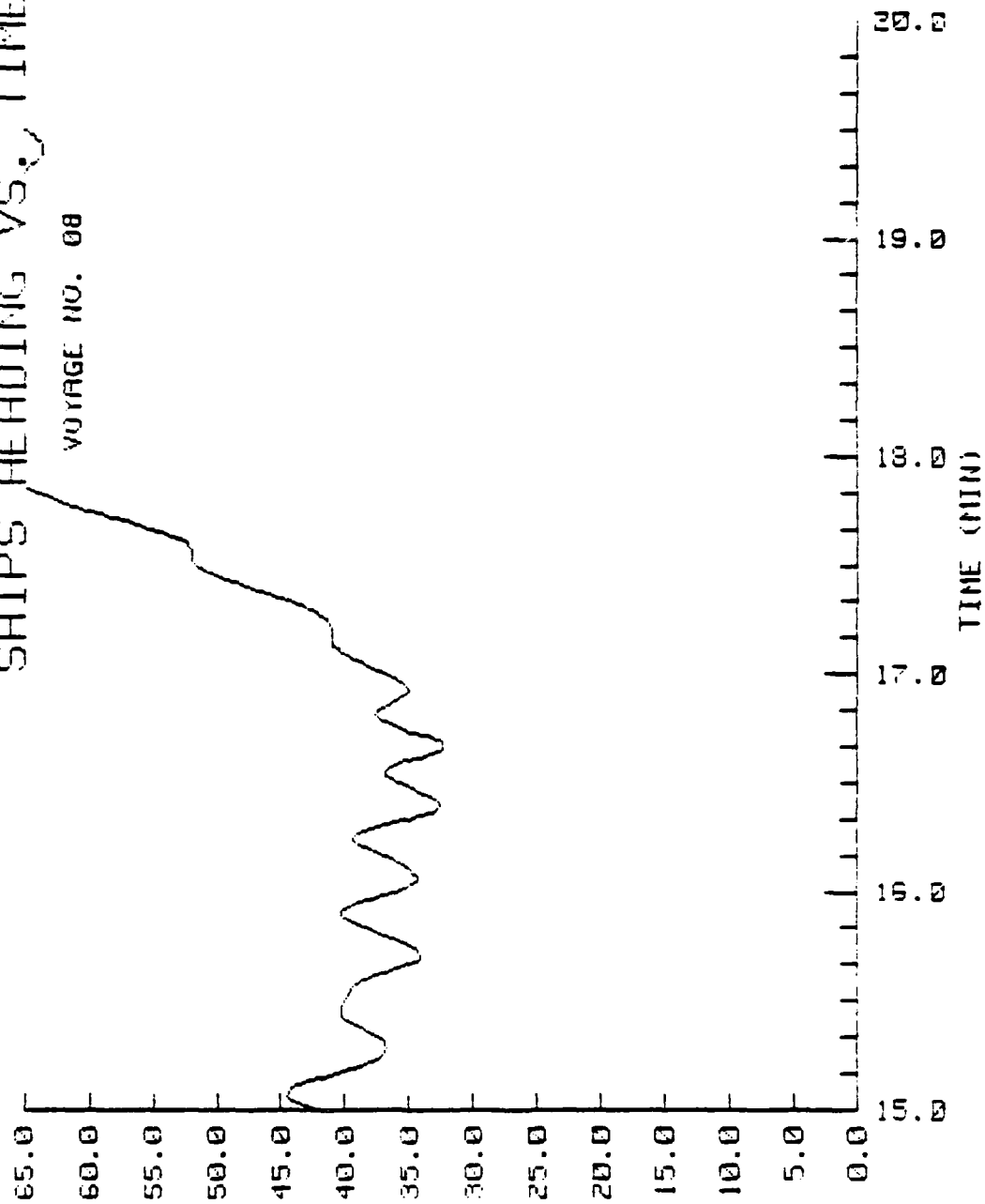


0000 00000000 000000



# SHIPS HEADING VS. TIME

VOYAGE NO. 08



SHIPS HEADING (DEG)



# STATISTICAL SUMMARY

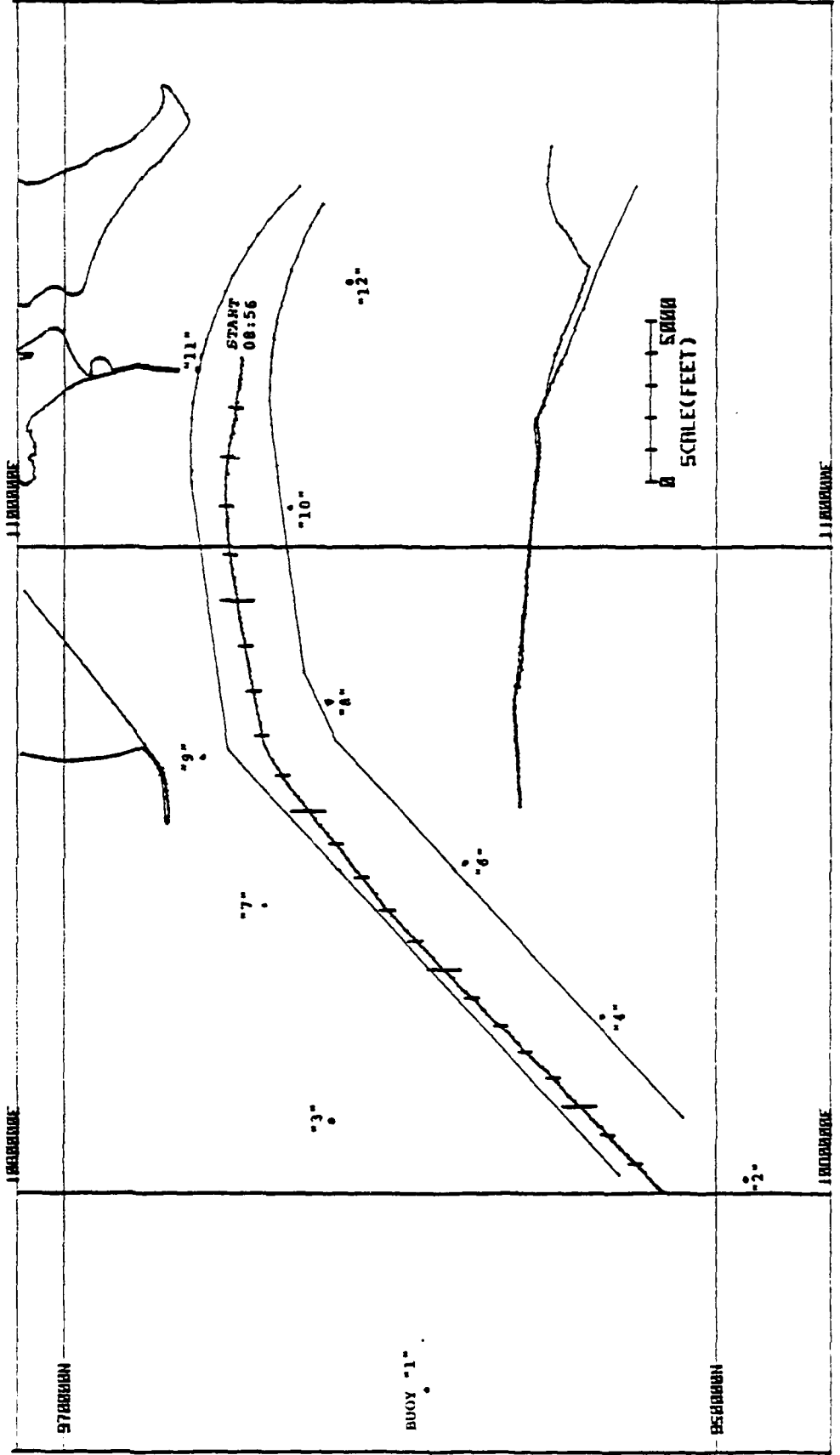
VOYAGE NO. 09

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	.4	1.7	.8	.8
ROLL (DEG)	1.0	6.2	2.3	2.6
AO (FT/SEC/SEC)	-.0	5.3	1.8	2.1
HEAVE (FT)	.0	6.6	2.7	3.0
BOW EXCUR. (FT)	.0	13.9	5.9	6.6
STERN EXCUR. (FT)	.0	10.1	3.6	4.1
SIDE EXCUR (FT)	.0	7.3	2.7	3.0



VOYAGE NO. 09 SHIP TRACK

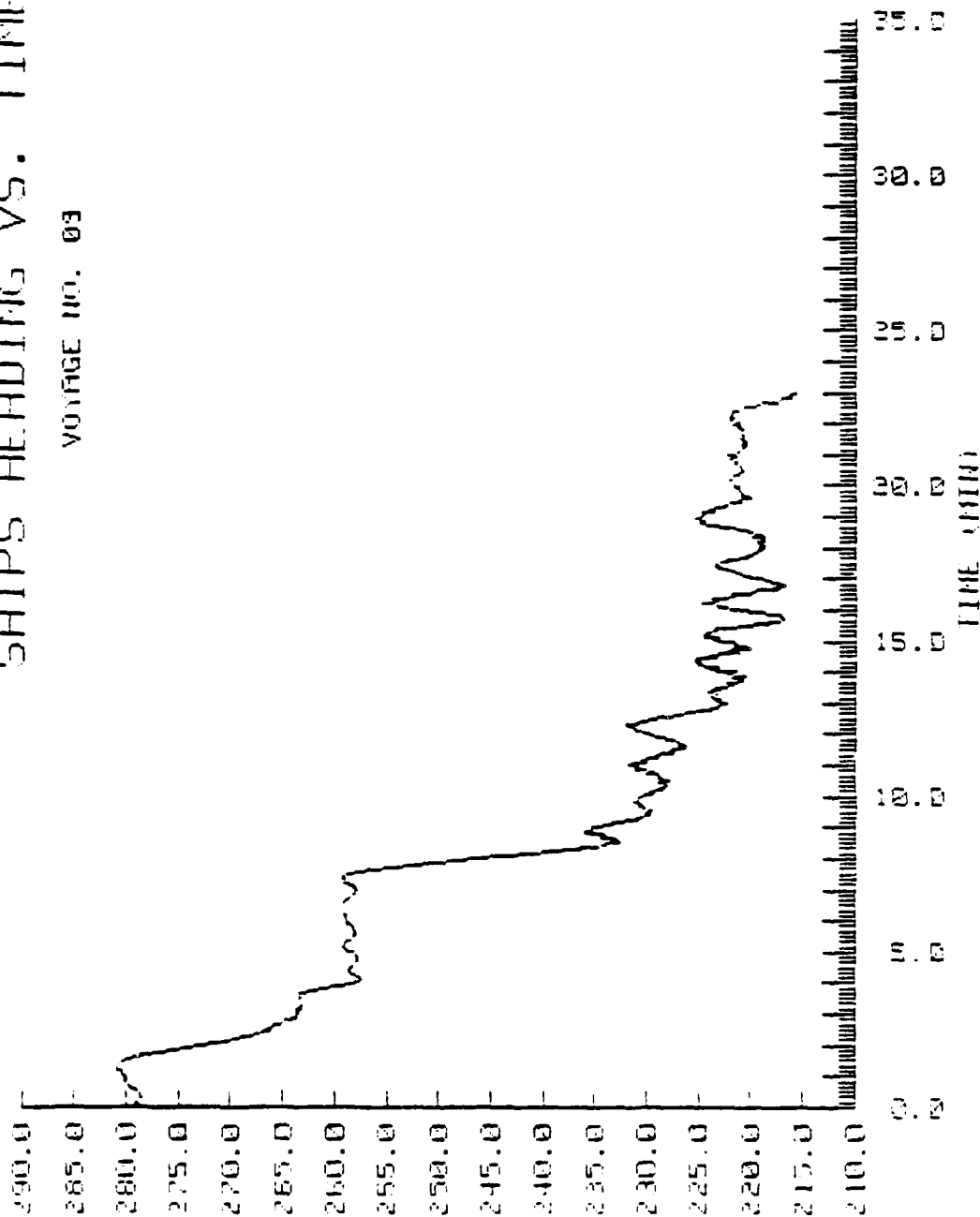
SCALE 1: 30000





# SHIPS HEADING VS. TIME

VOYAGE NO. 03

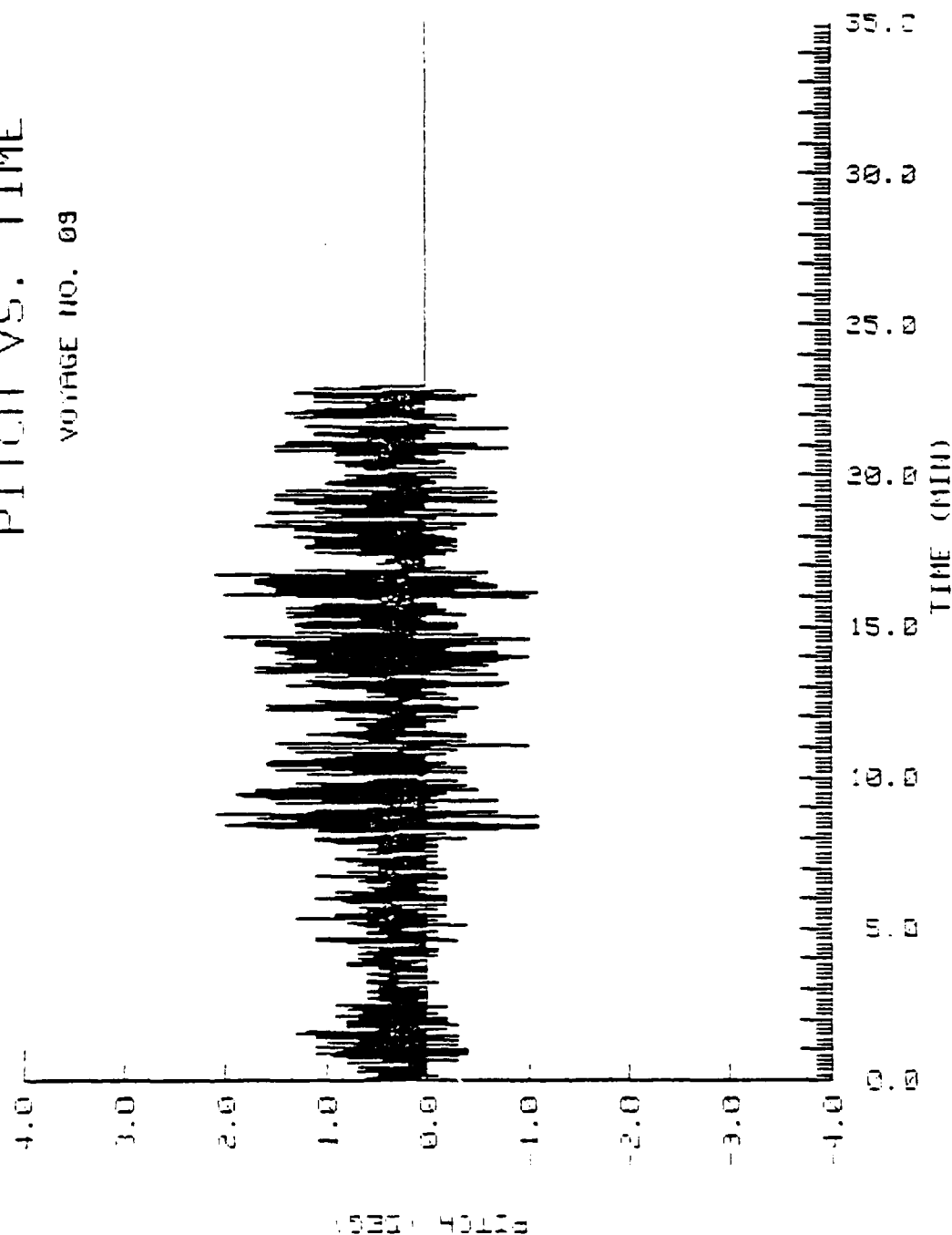


0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10



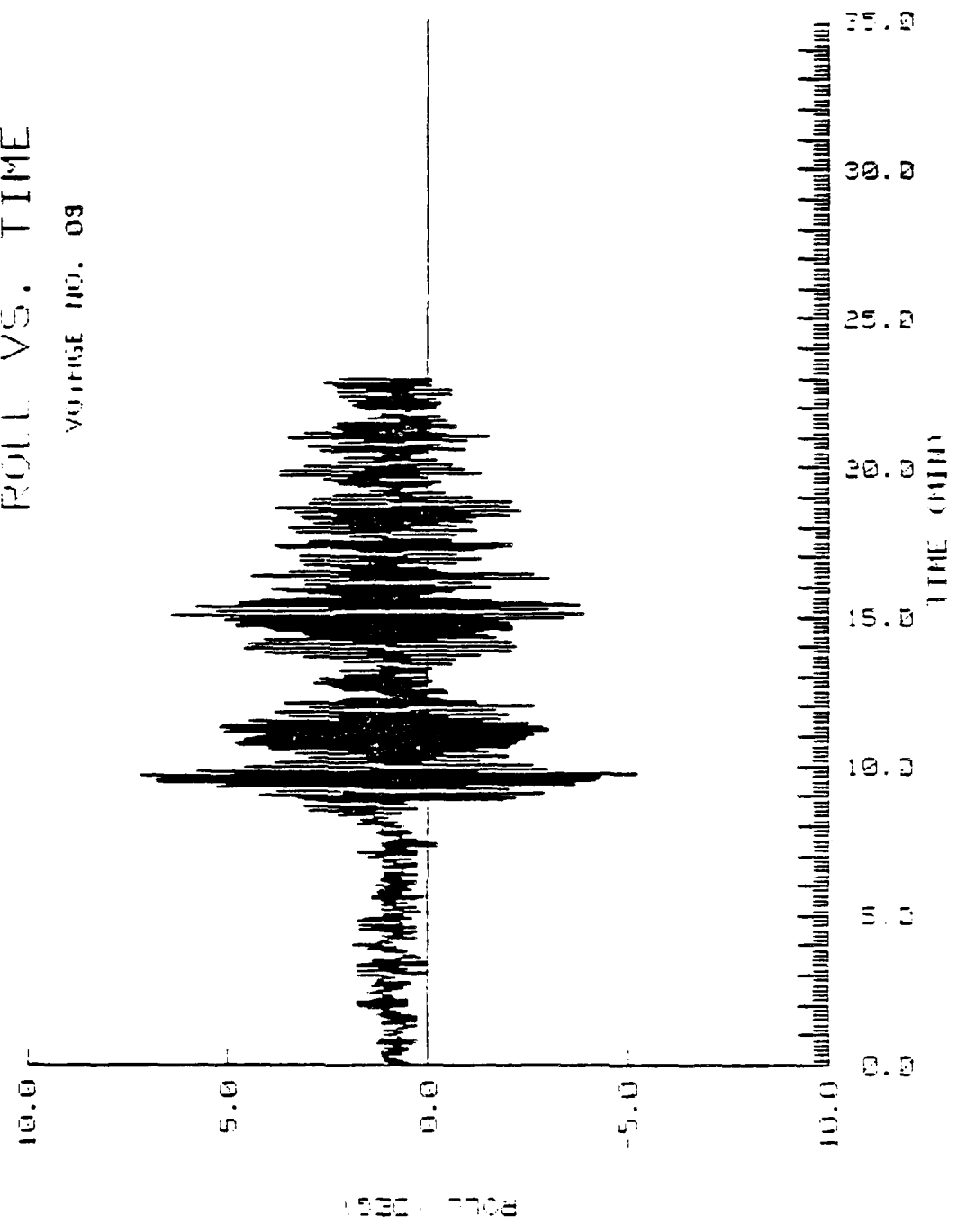
# PITCH VS. TIME

VOLTAGE NO. 09





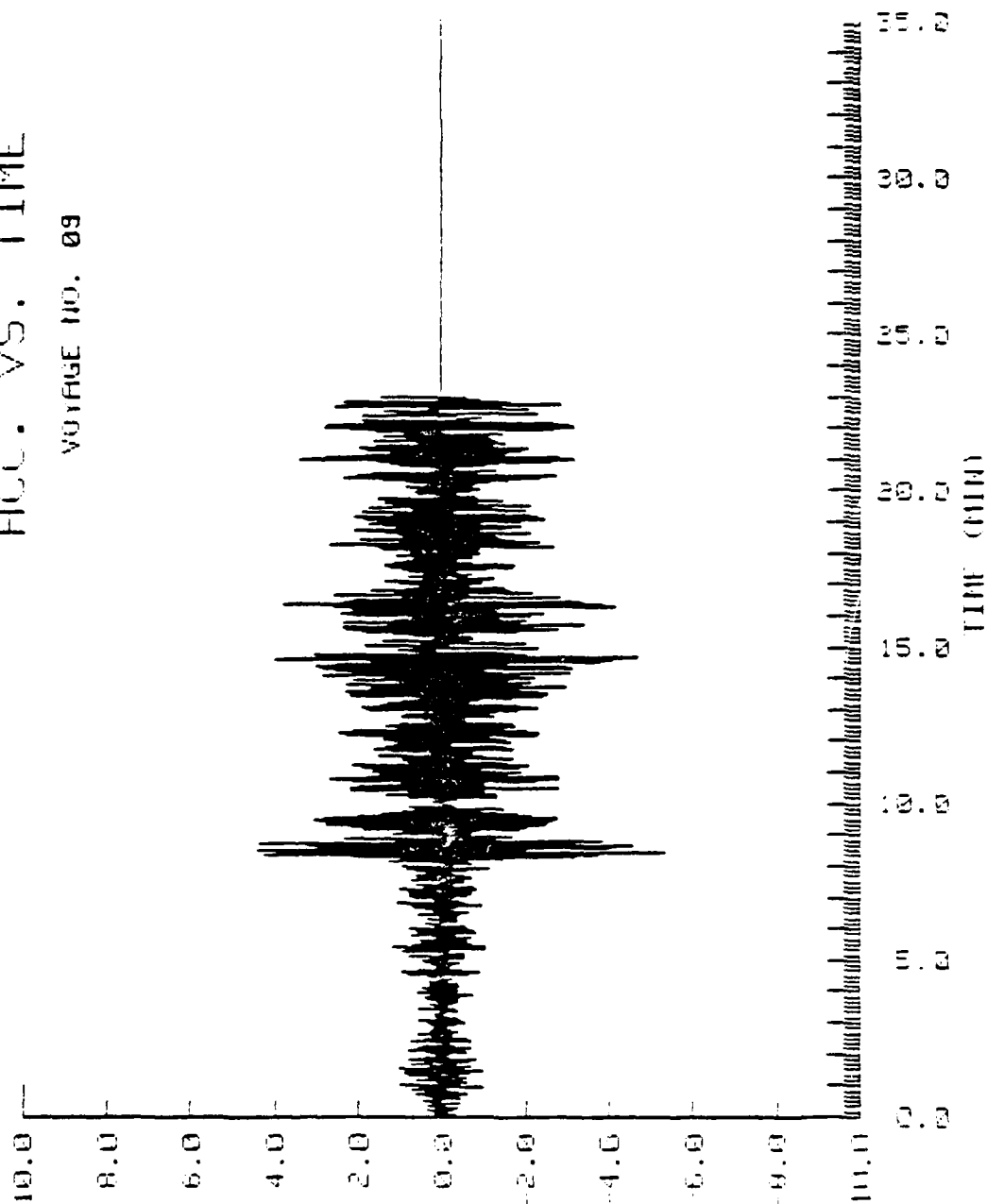
ROLL VS. TIME  
VOICE NO. 08





# ACC. VS. TIME

VOLUME NO. 09



ACC. VS. TIME



AD-A090 904

TETRA TECH INC PASADENA CA

F/6 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.—ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

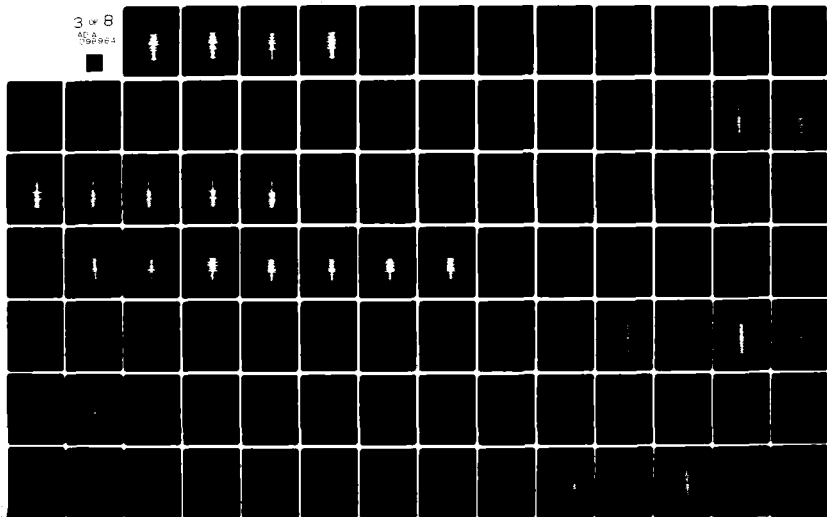
UNCLASSIFIED

TETRA-T-3925-APP-A(1)

NL

3 of 8

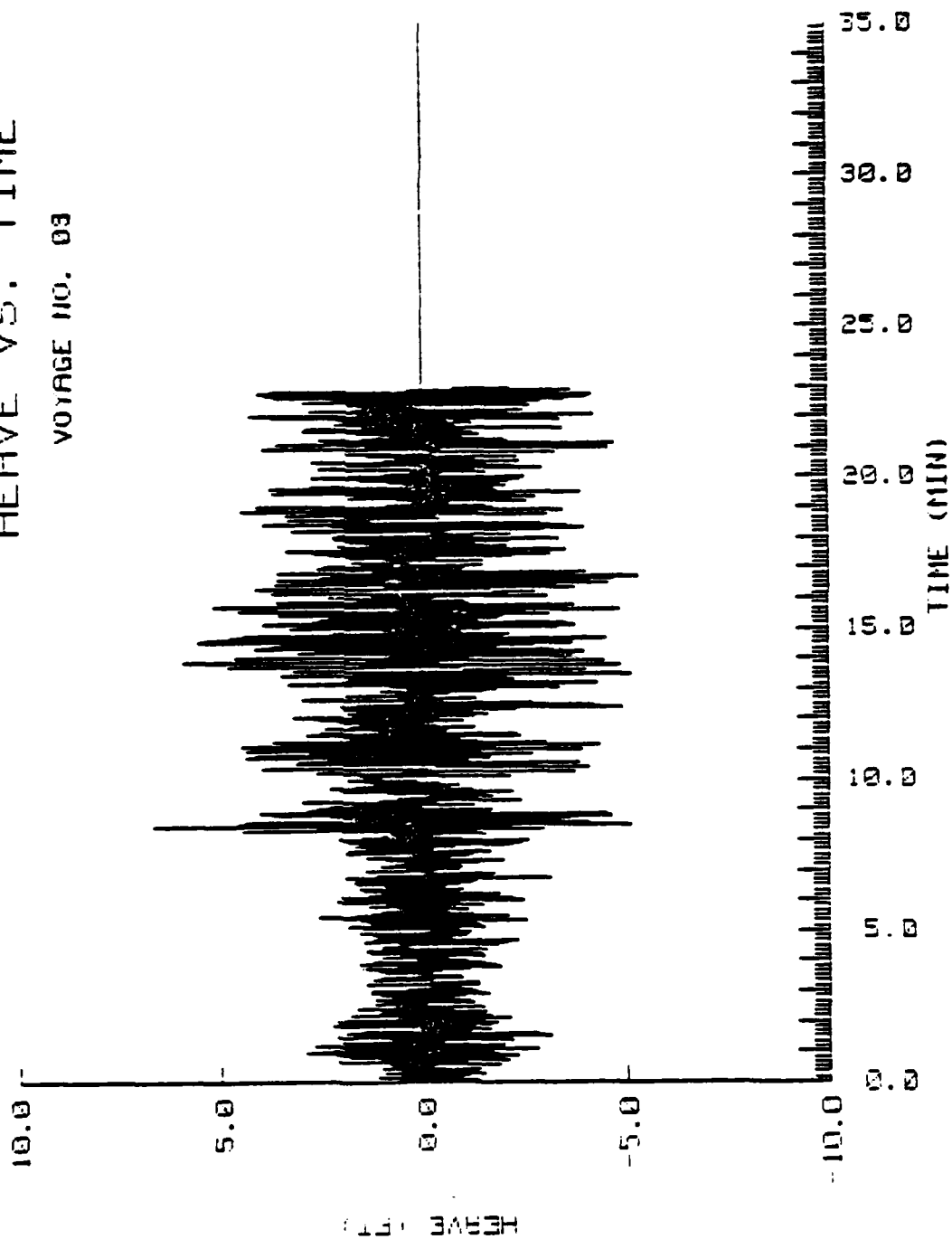
AE 8.0  
796 p.4





# HEAVE VS. TIME

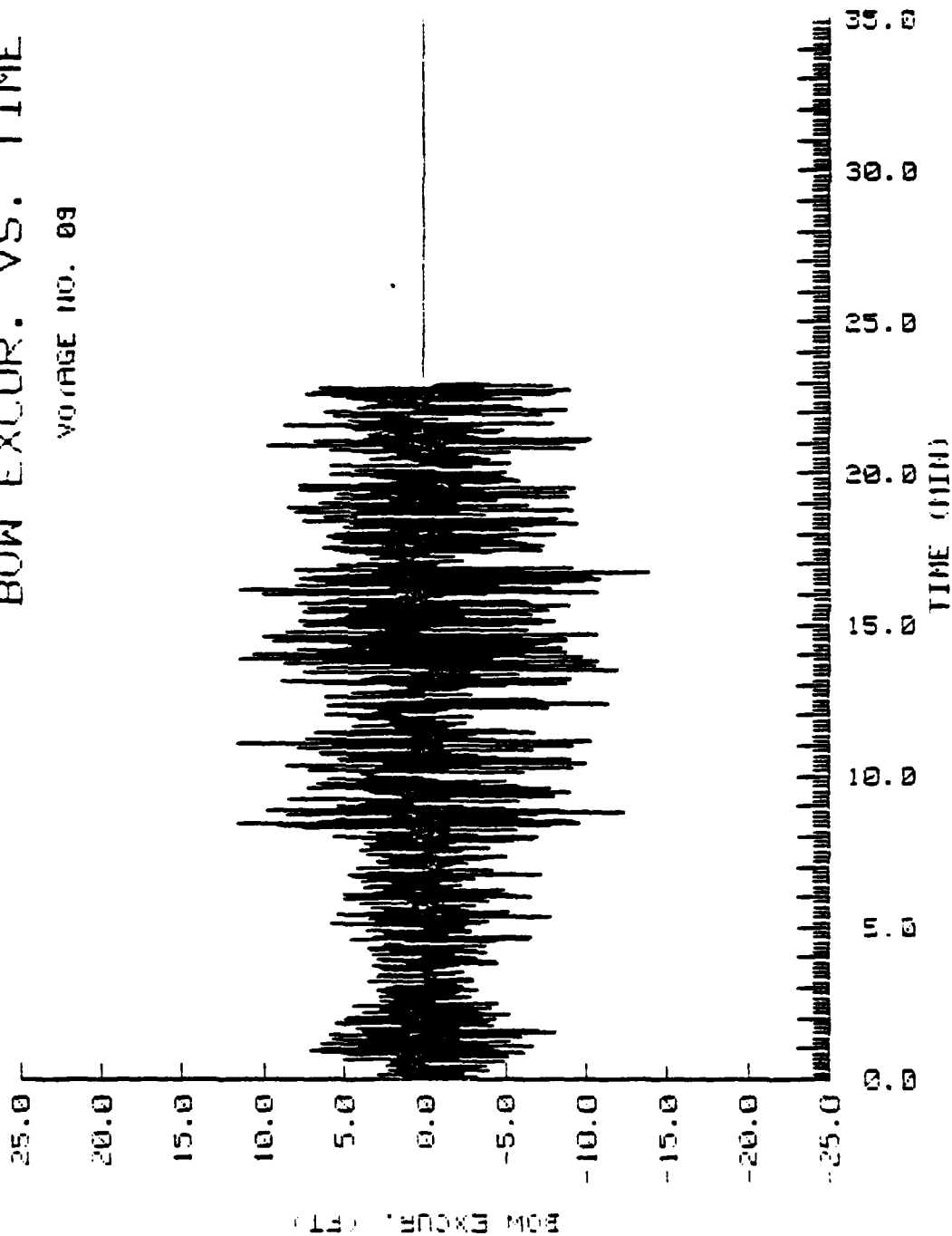
VOYAGE NO. 03





# BOW EXCUR. VS. TIME

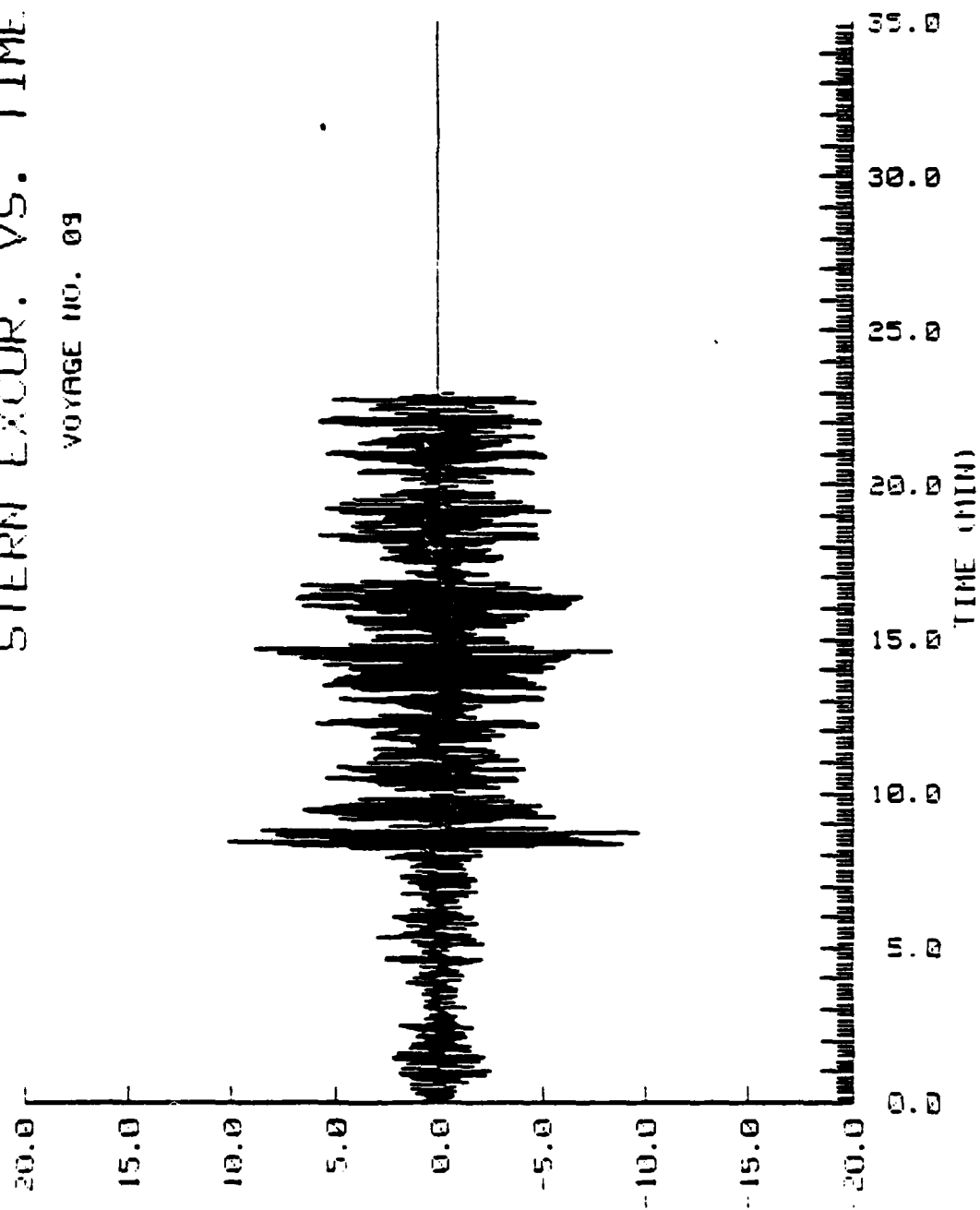
VOLAGE NO. 09





# STERN EXCUR. VS. TIME

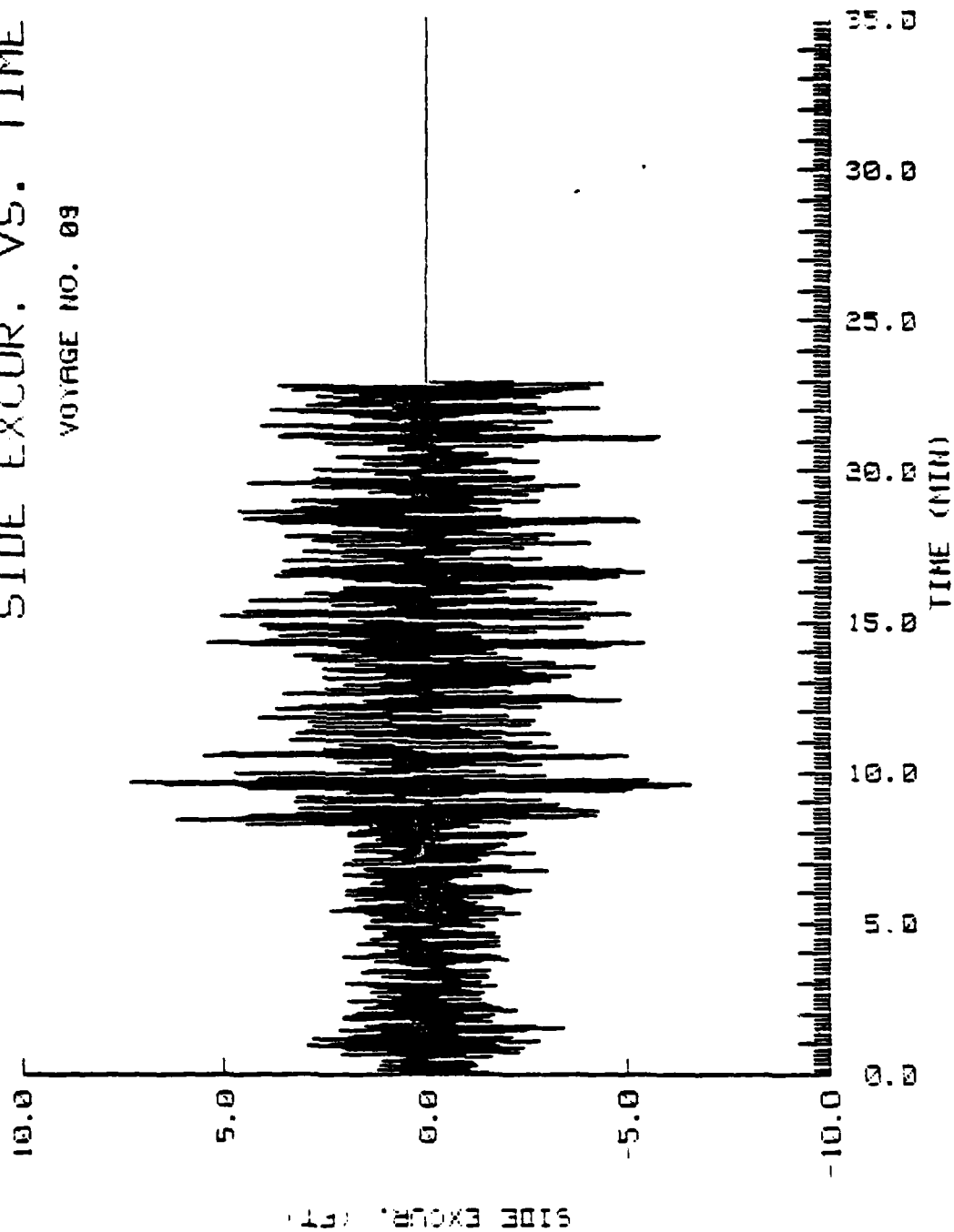
VOYAGE NO. 09



STERN EXCUR. VS. TIME



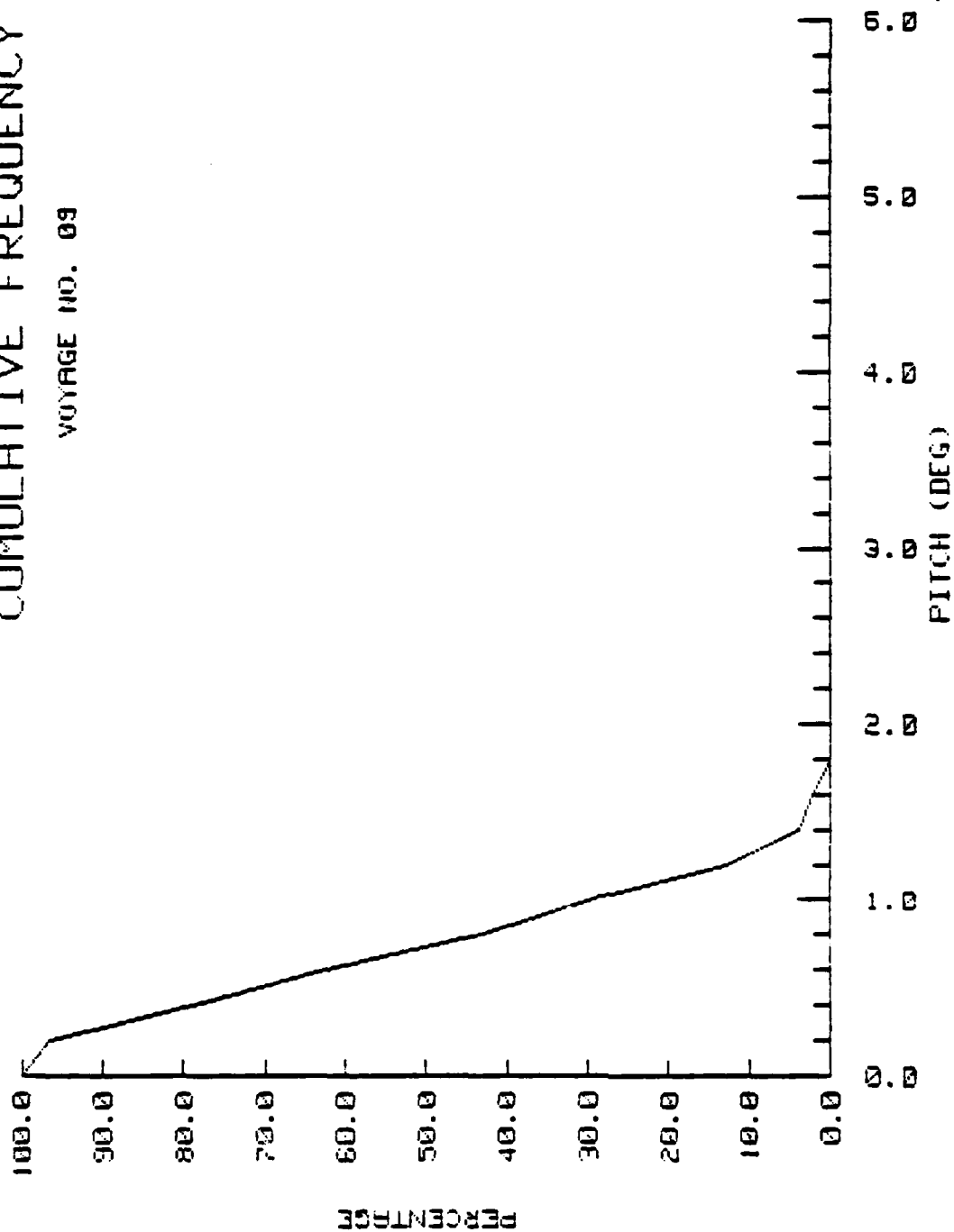
SIDE EXCUR. VS. TIME  
VOYAGE NO. 09





# CUMULATIVE FREQUENCY

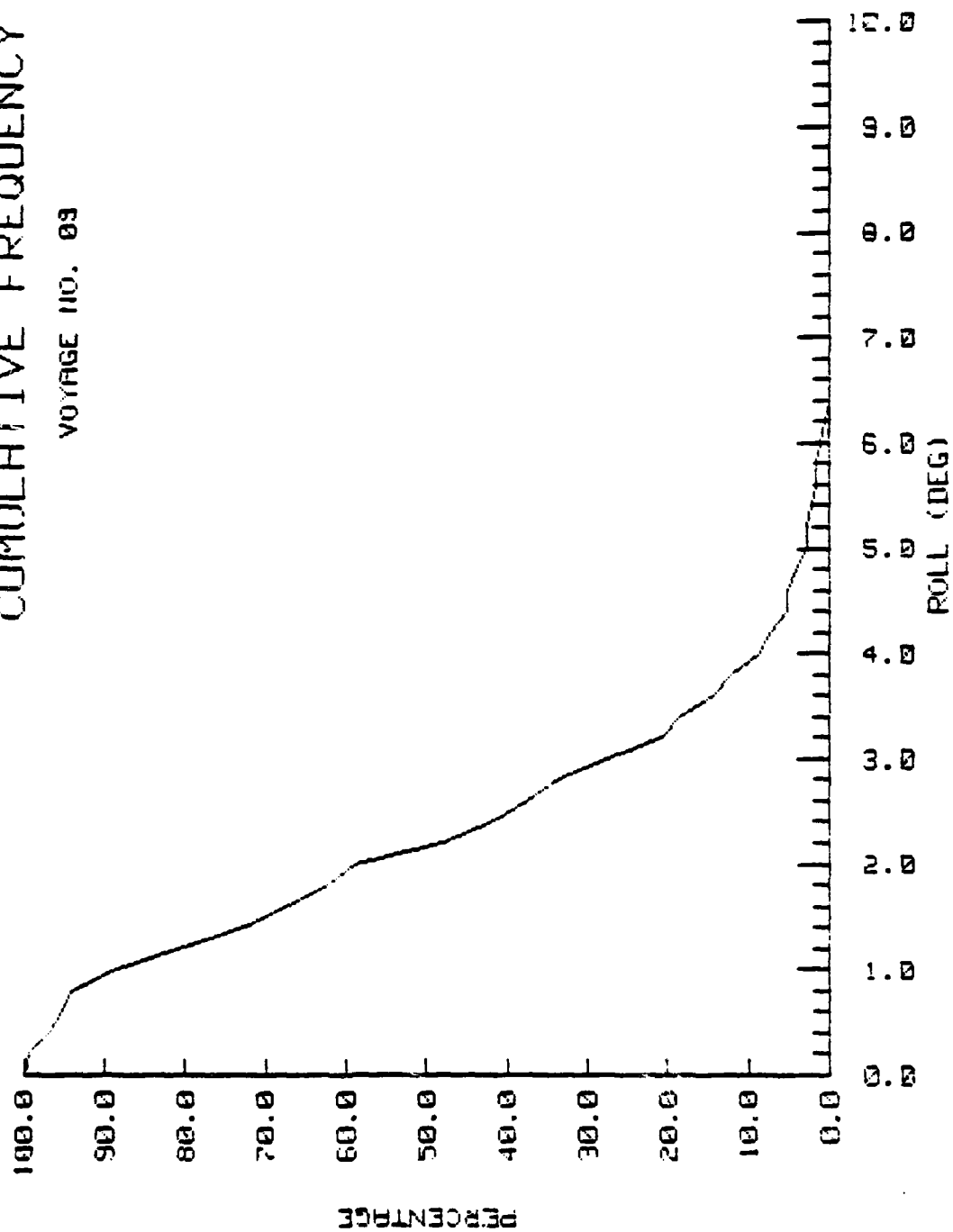
VOYAGE NO. 09





# CUMULATIVE FREQUENCY

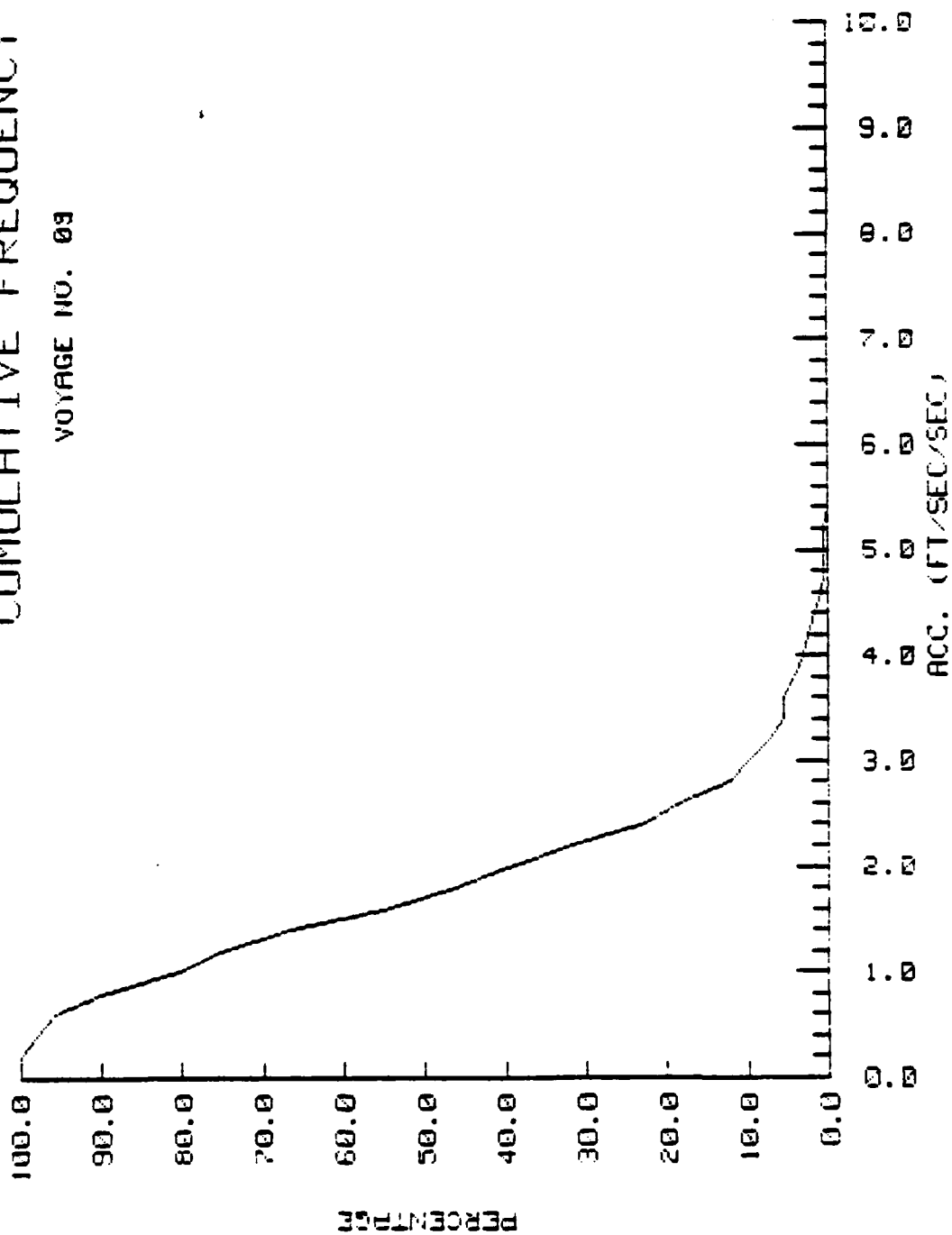
VOYAGE NO. 03





# CUMULATIVE FREQUENCY

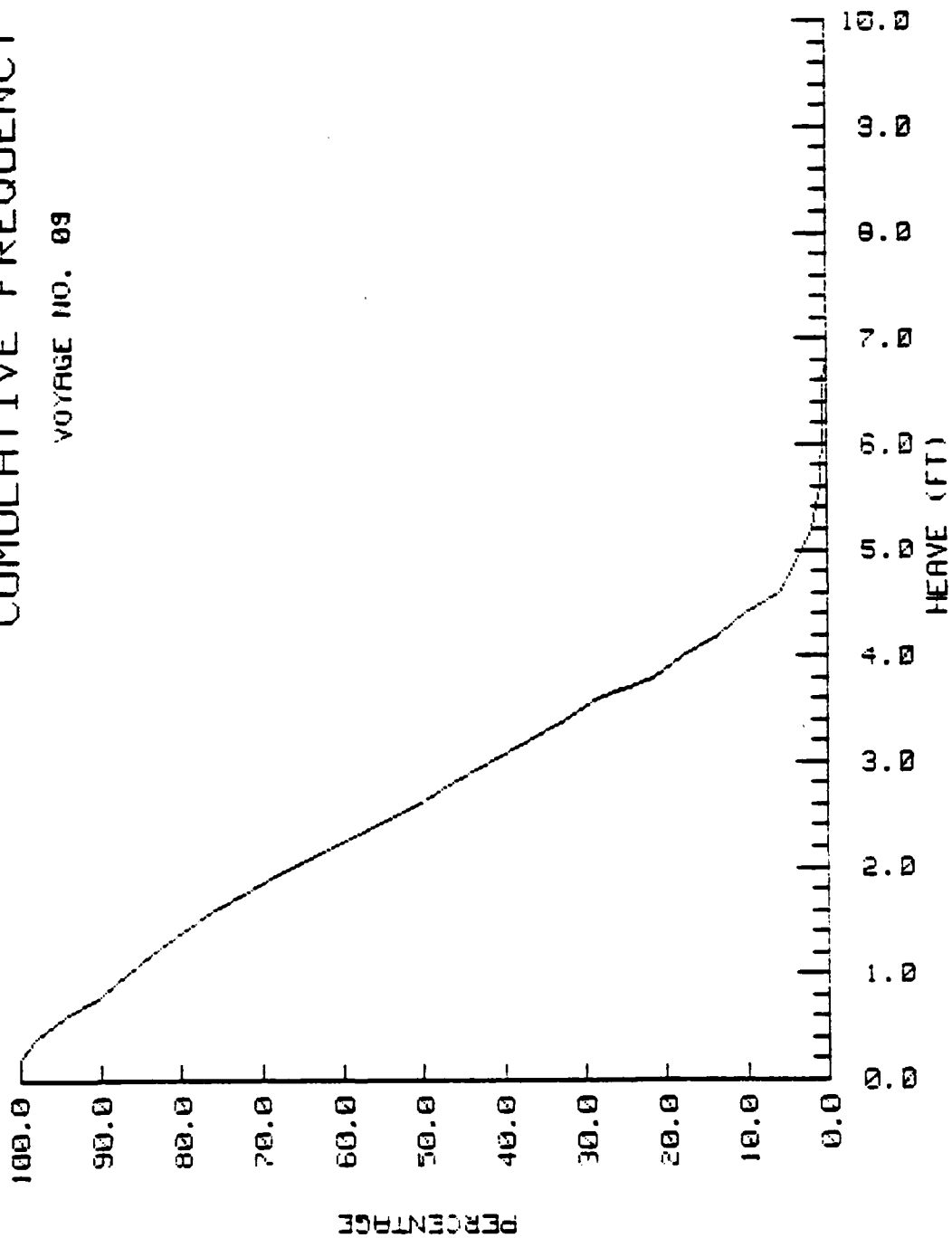
VOYAGE NO. 03





# CUMULATIVE FREQUENCY

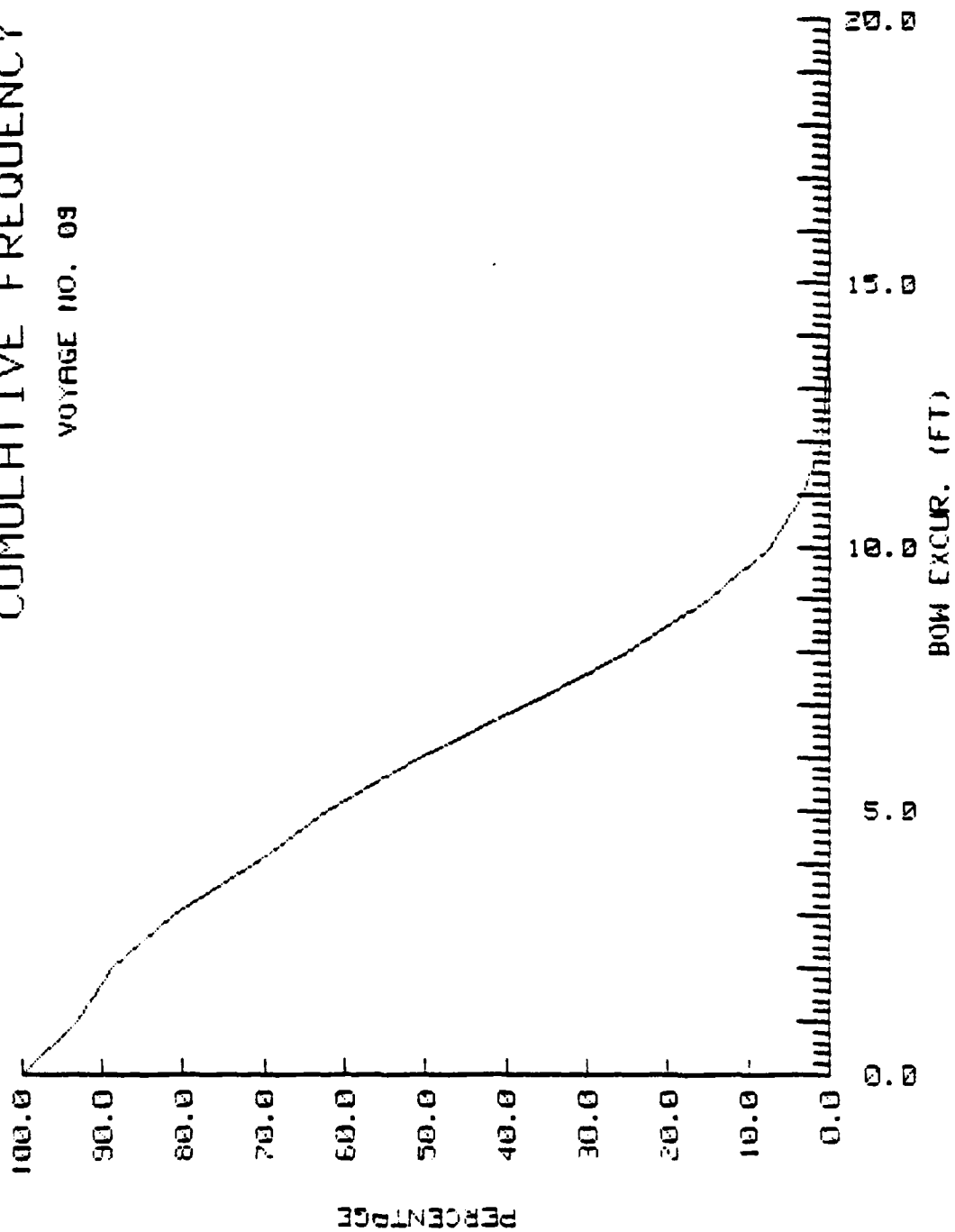
VOYAGE NO. 09





# CUMULATIVE FREQUENCY

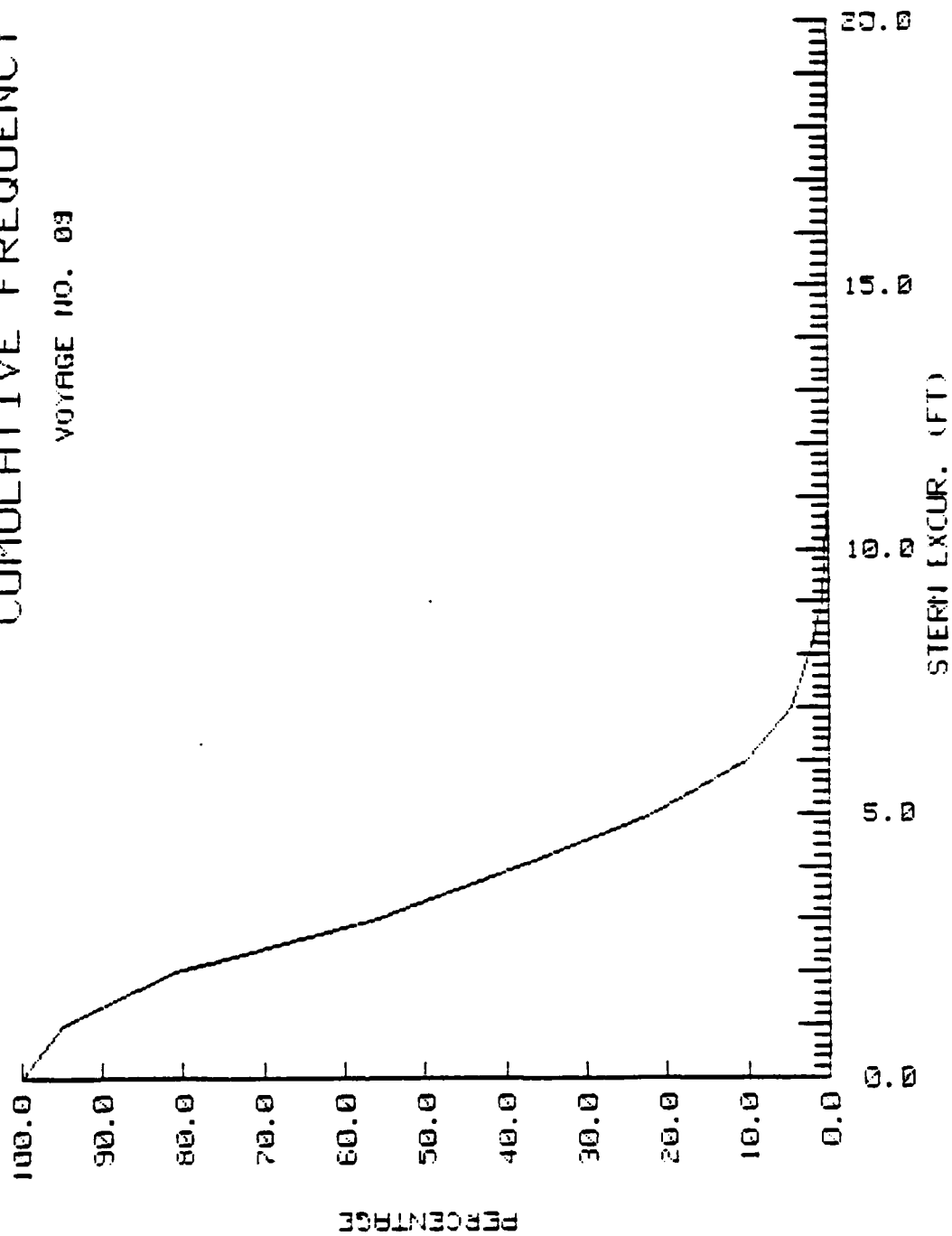
VOYAGE NO. 03





# CUMULATIVE FREQUENCY

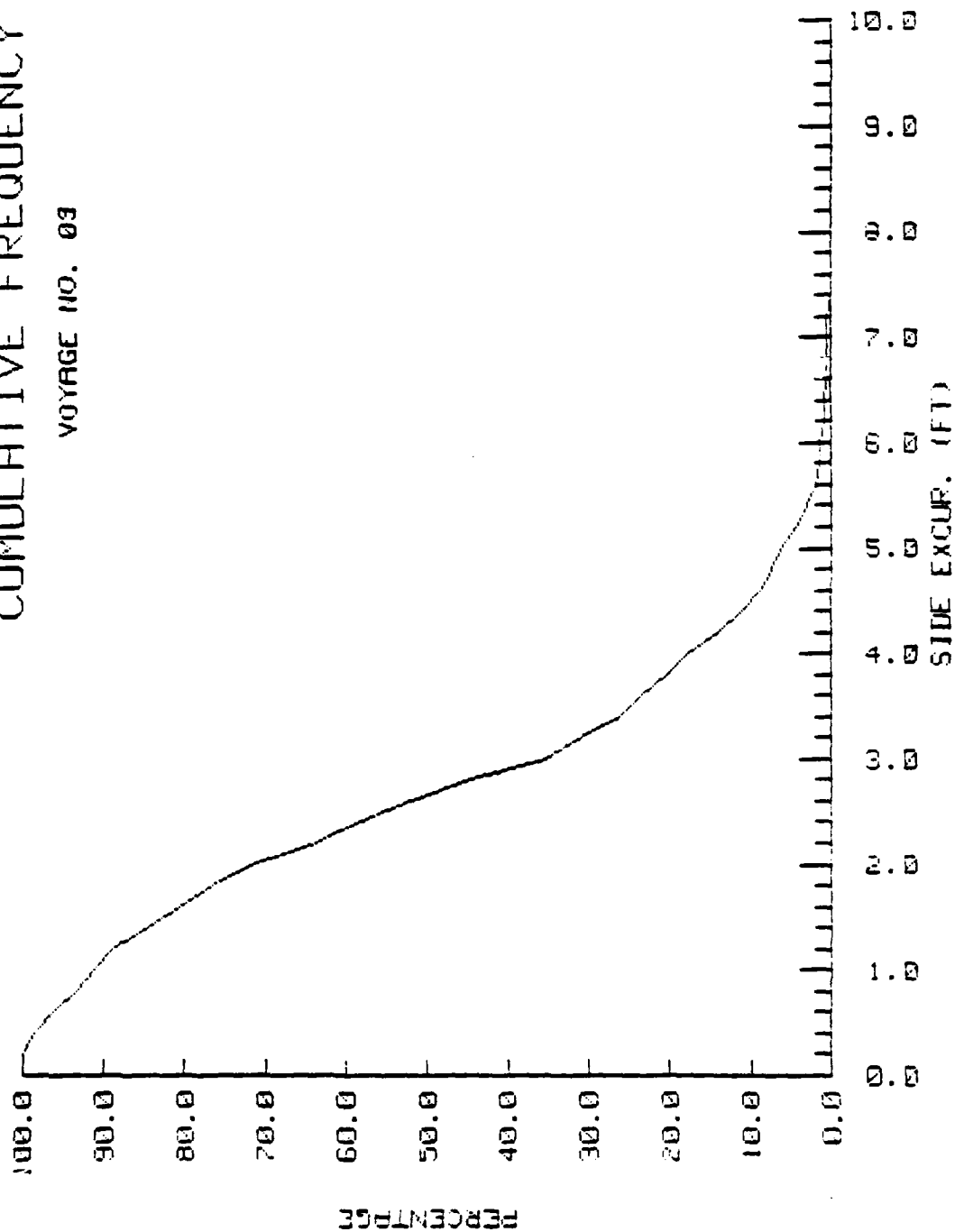
VOYAGE NO. 03





# CUMULATIVE FREQUENCY

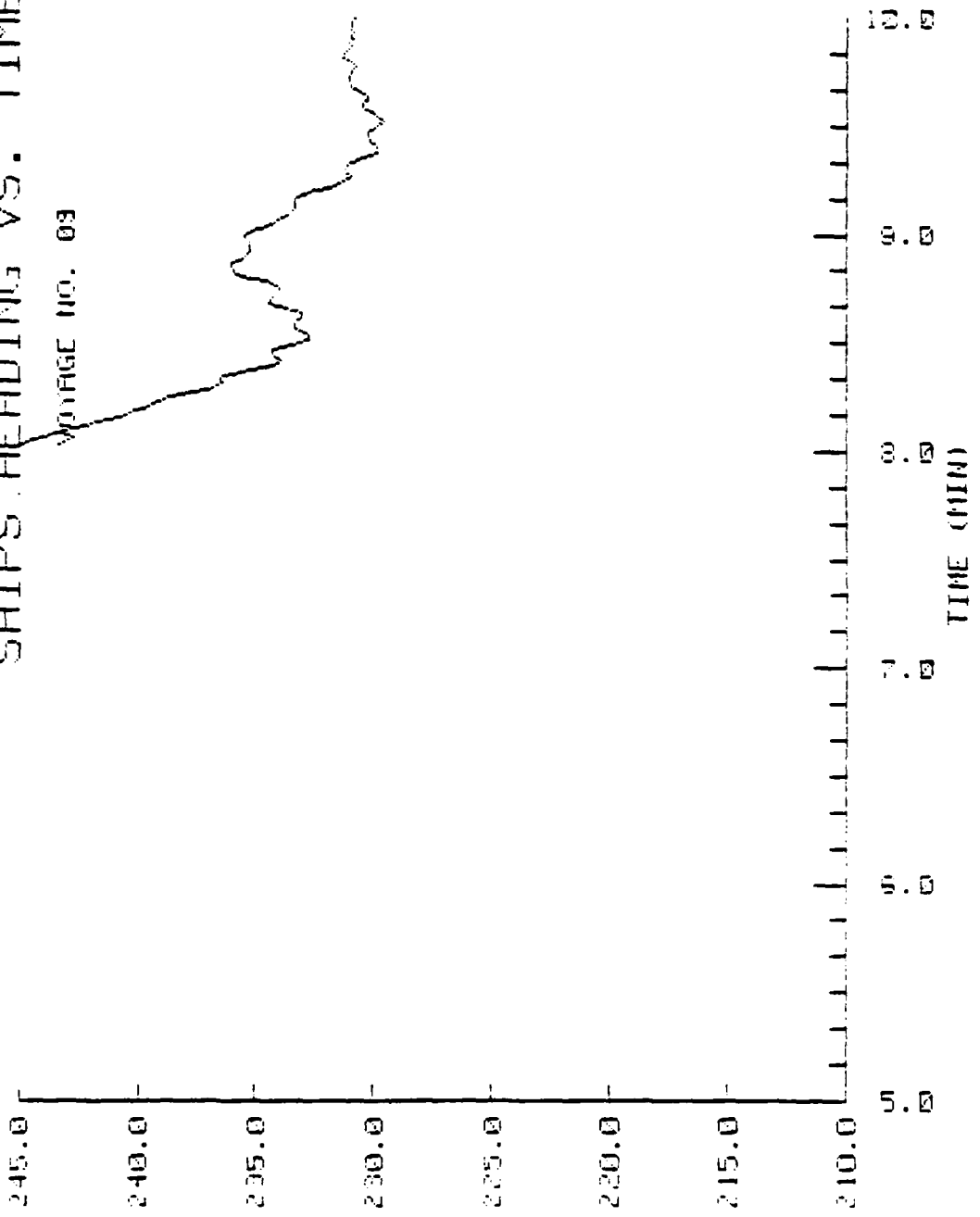
VOYAGE NO. 03





# SHIPS HEADING VS. TIME

VOYAGE NO. 03

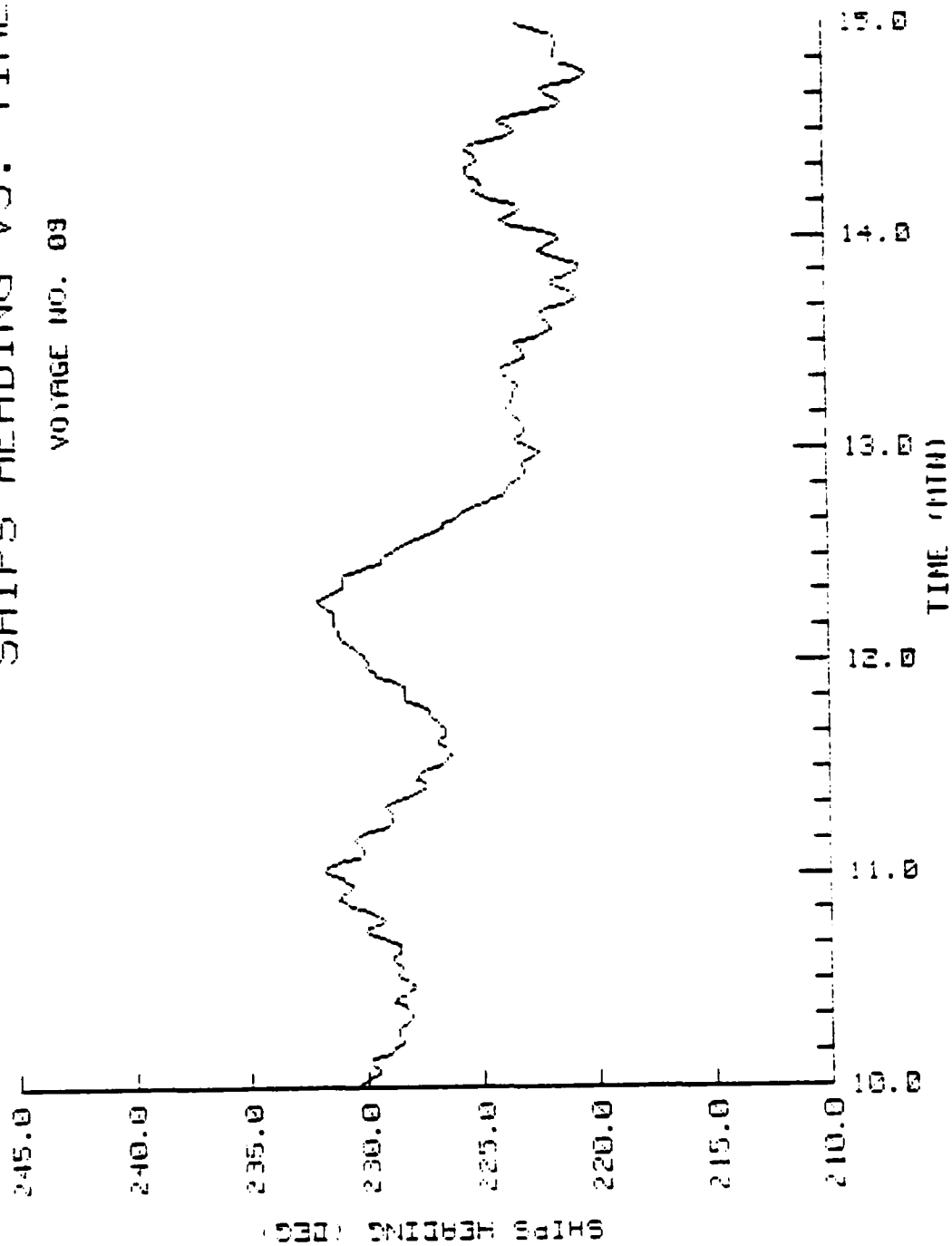


(0000) 02110000 000000



# SHIPS HEADING VS. TIME

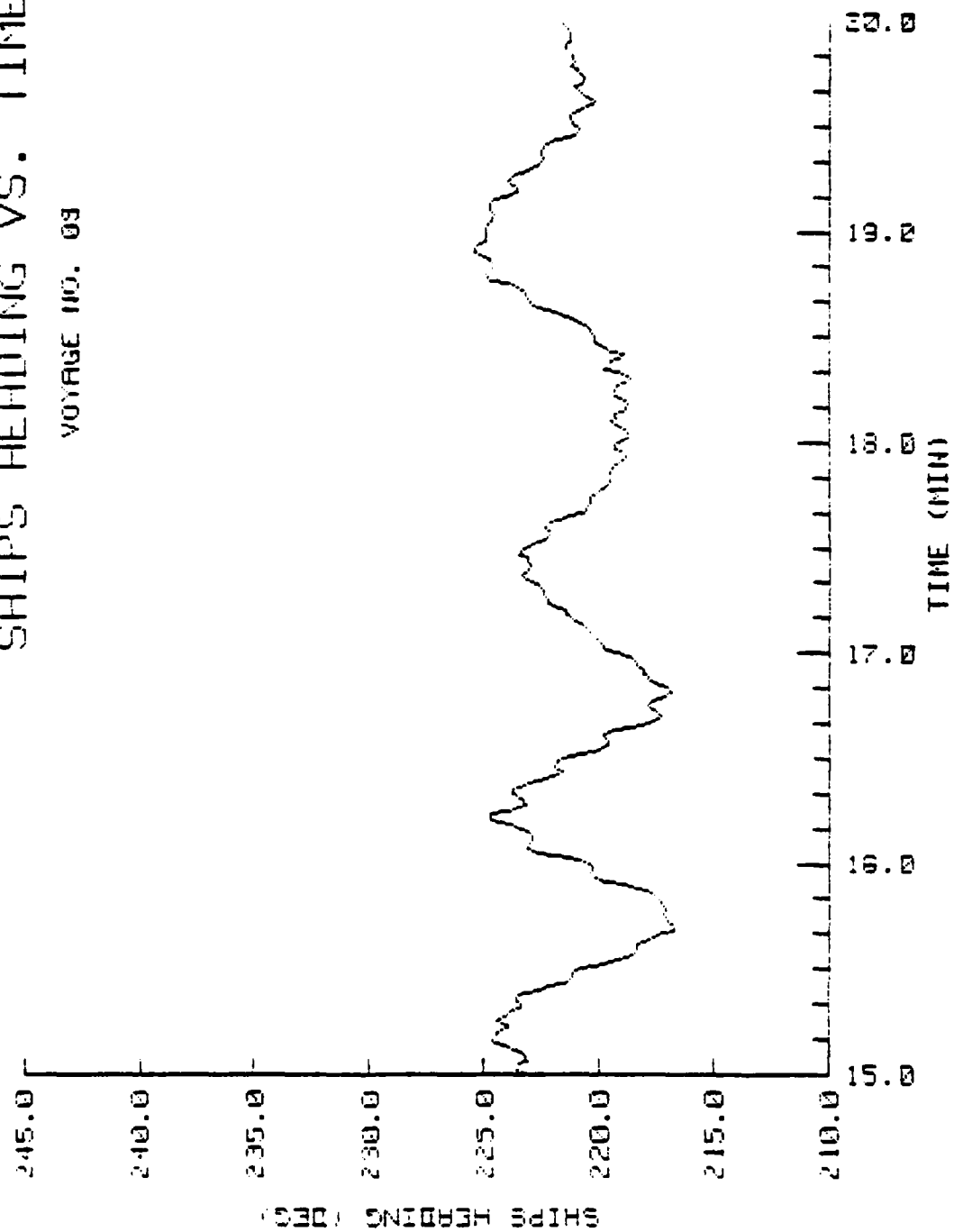
VOYAGE NO. 09





# SHIPS HEADING VS. TIME

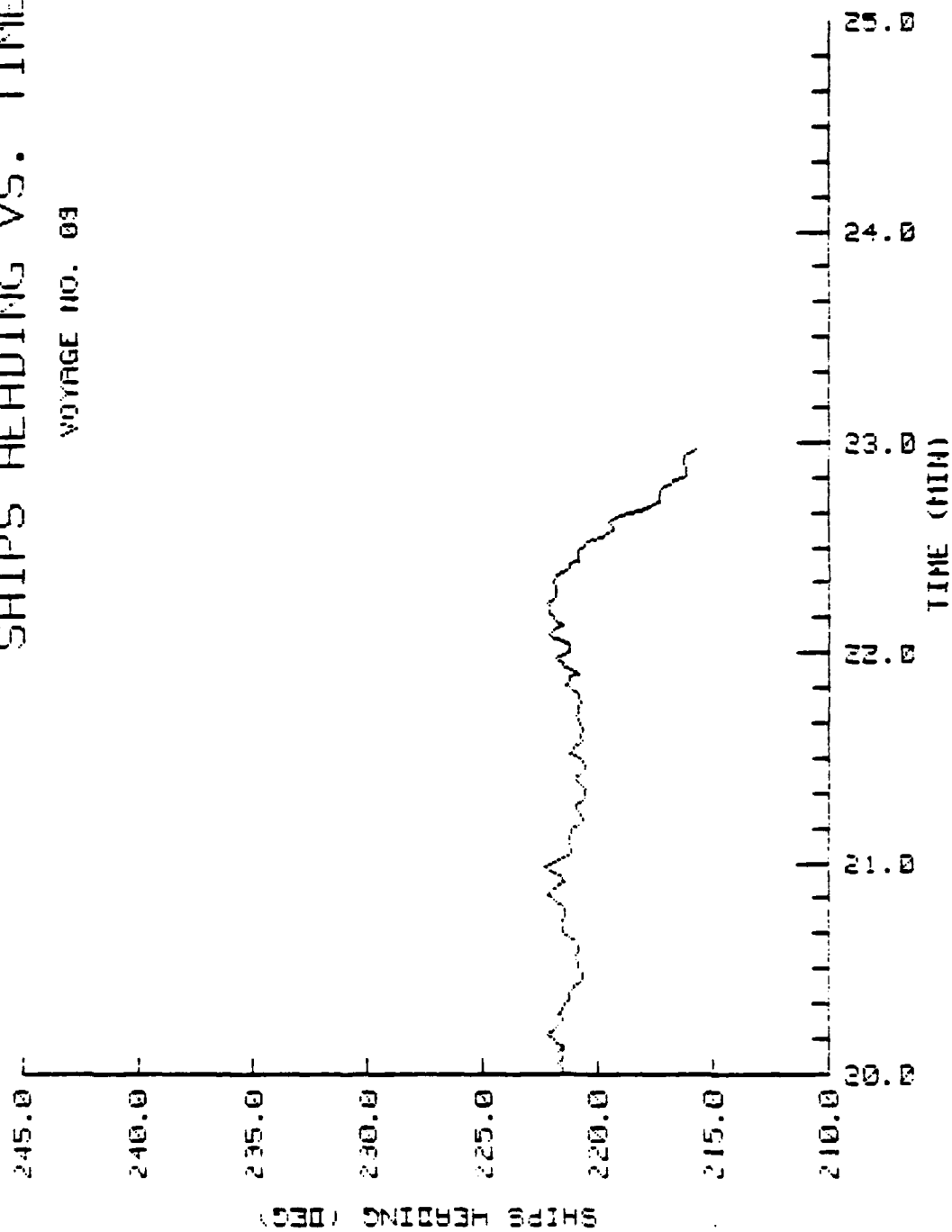
VOYAGE NO. 03





# SHIPS HEADING VS. TIME

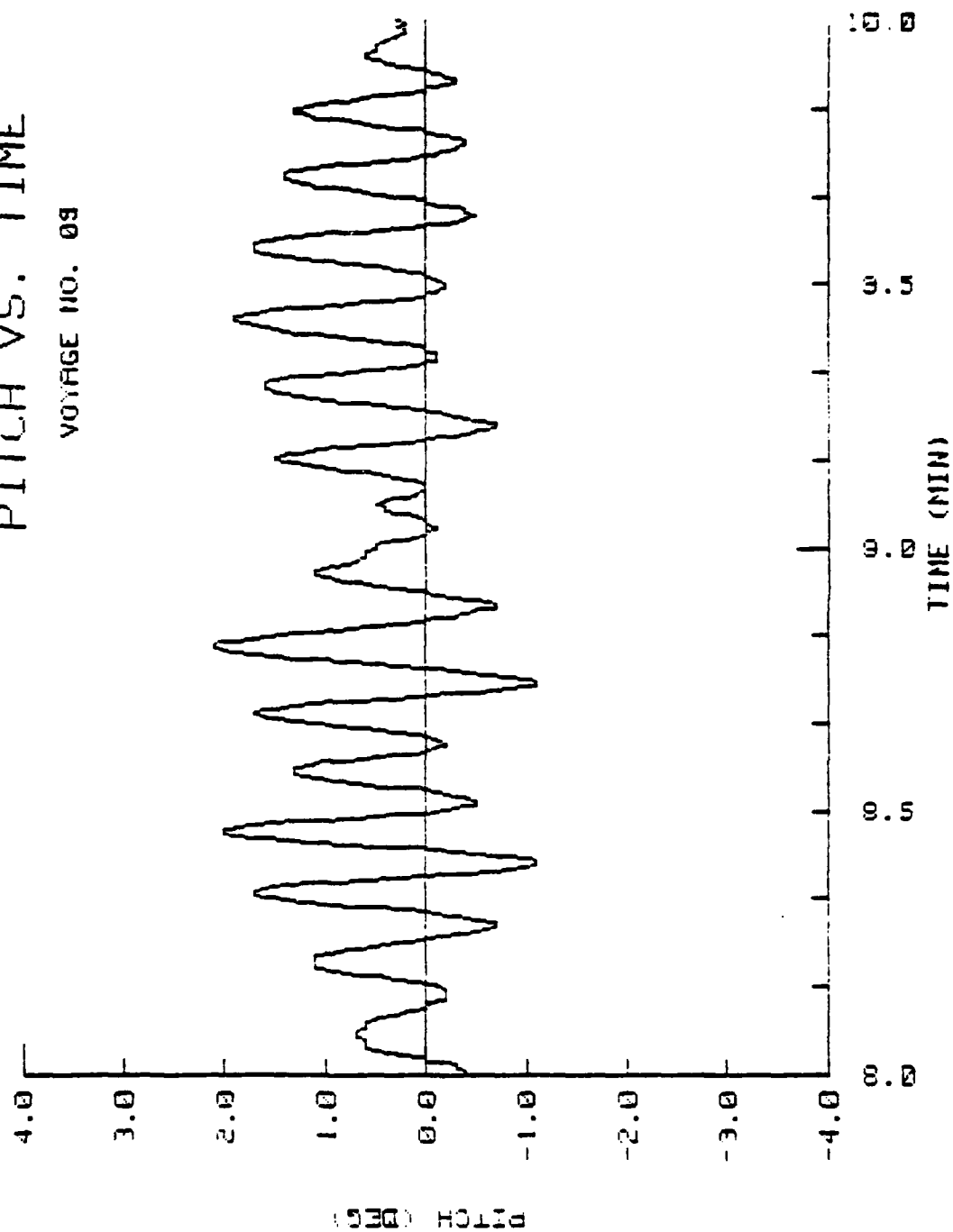
VOYAGE NO. 03





# PITCH VS. TIME

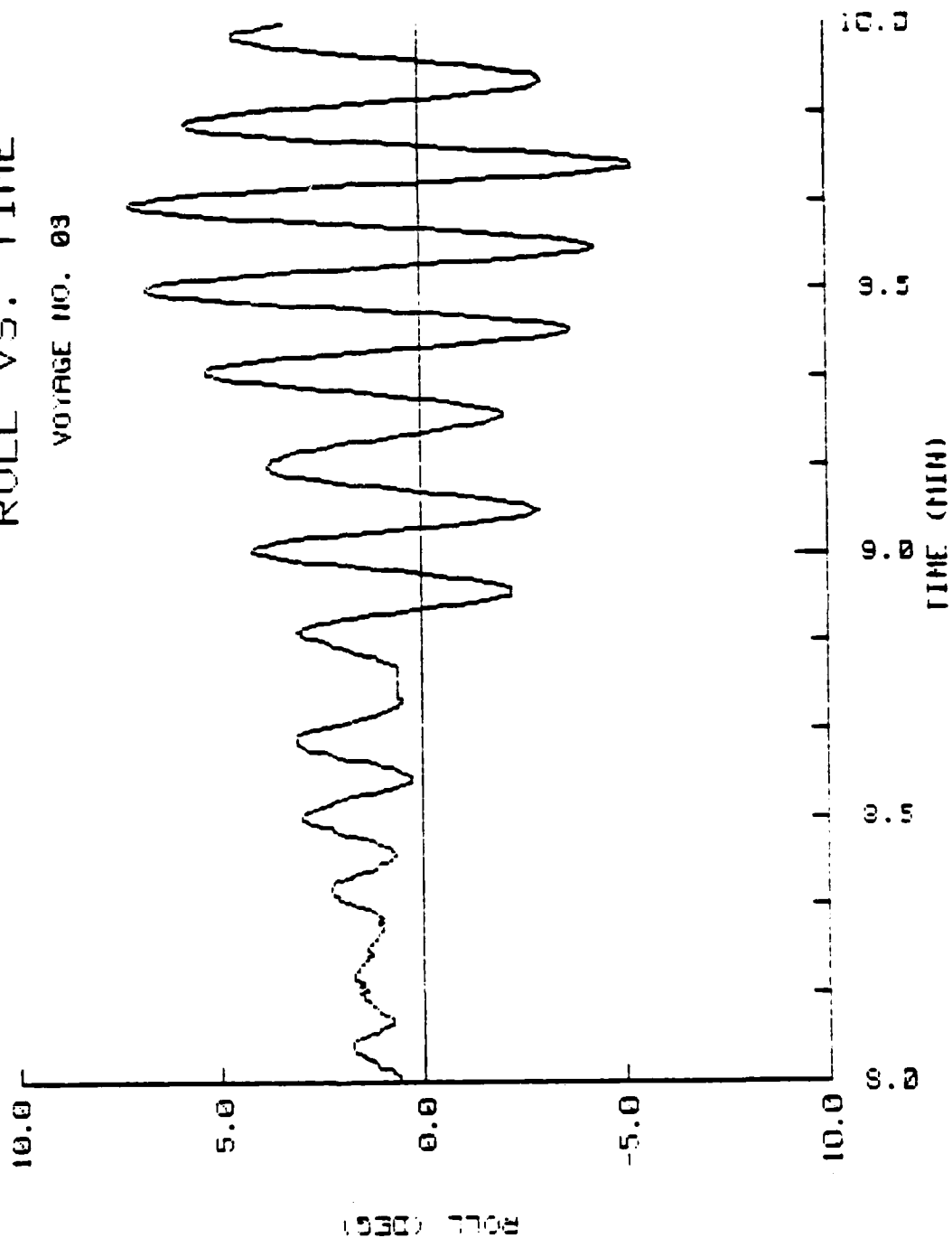
VOLUME NO. 09





# ROLL VS. TIME

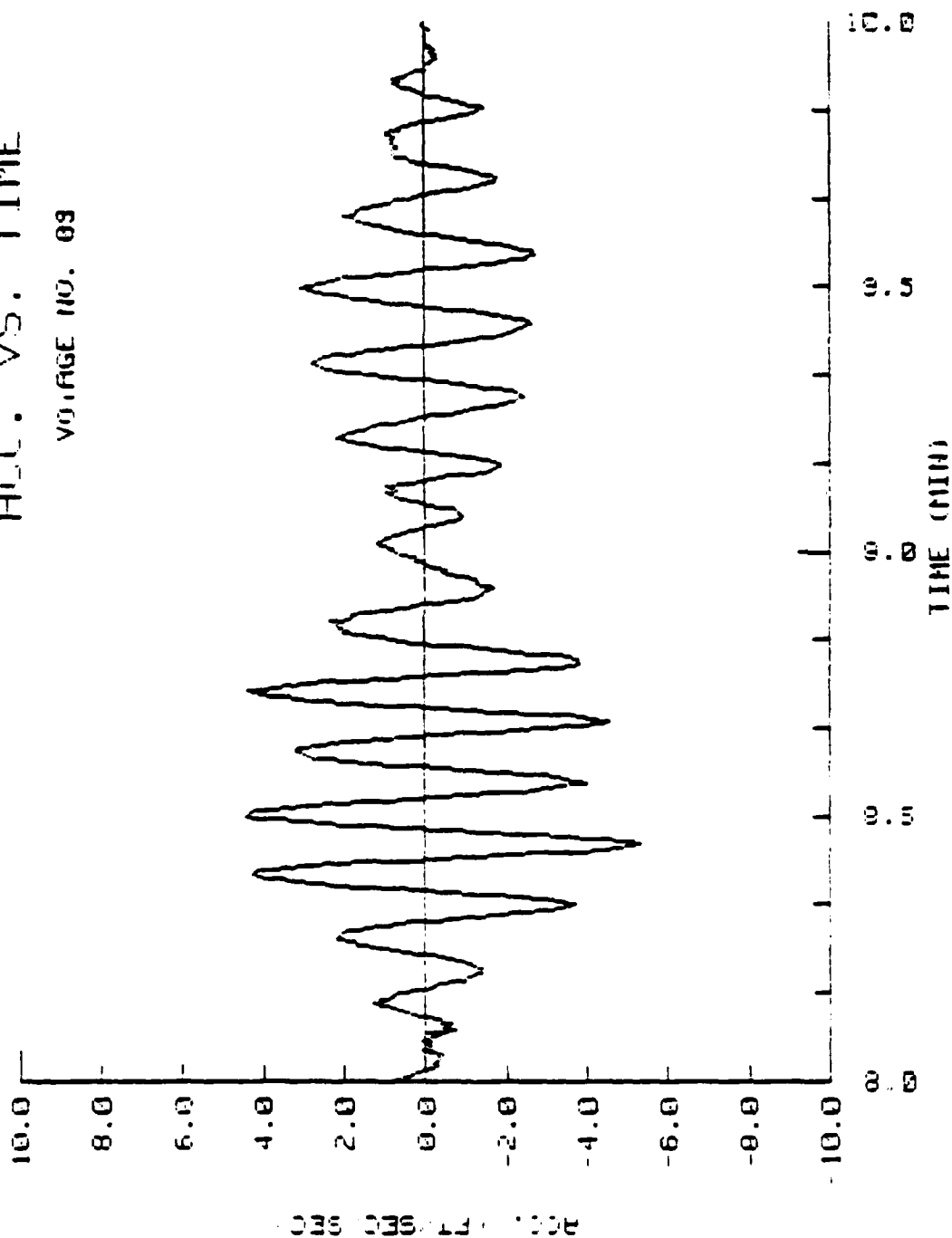
VOYAGE NO. 03





ACC. VS. TIME

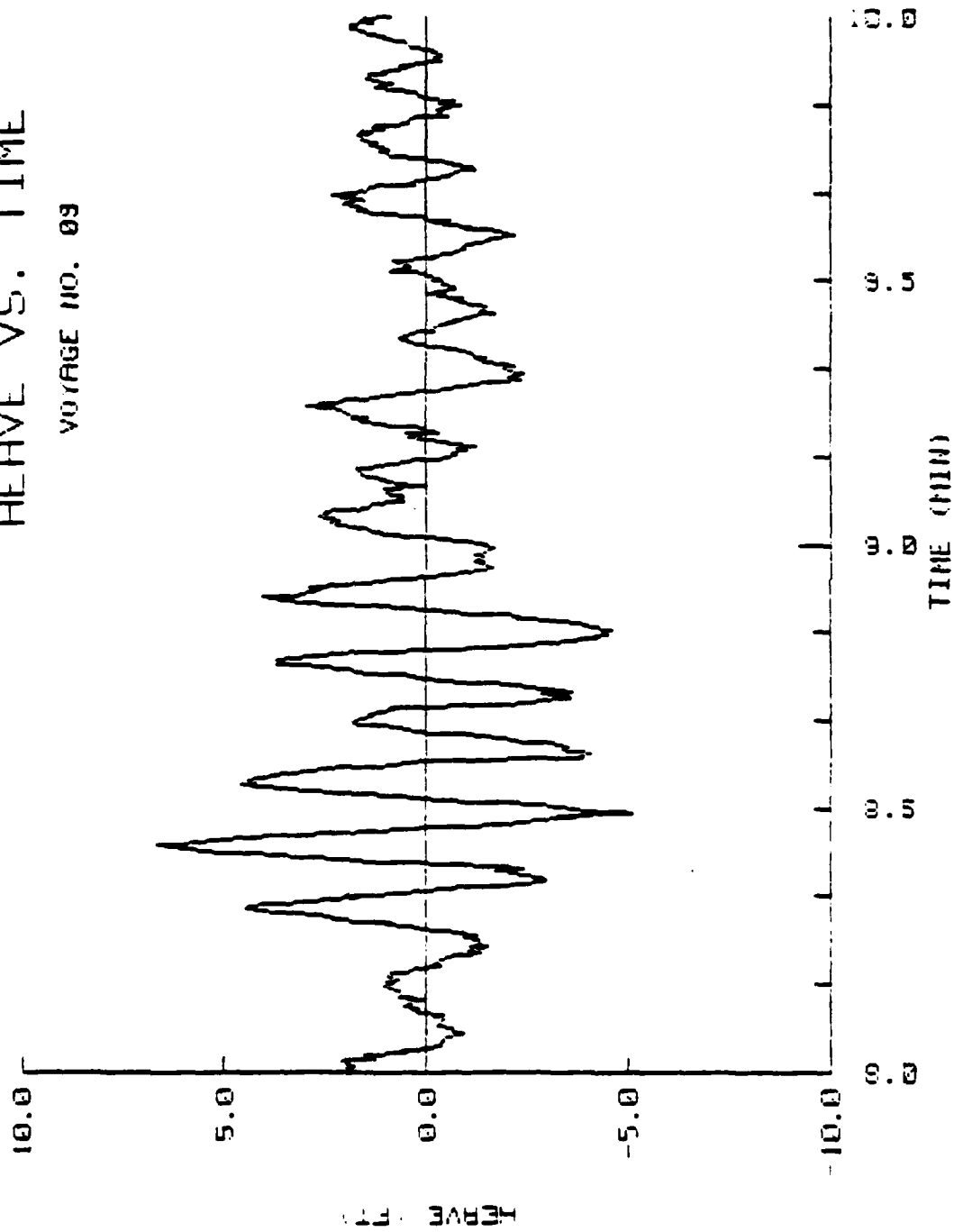
VOLAGE NO. 03





# HEAVE VS. TIME

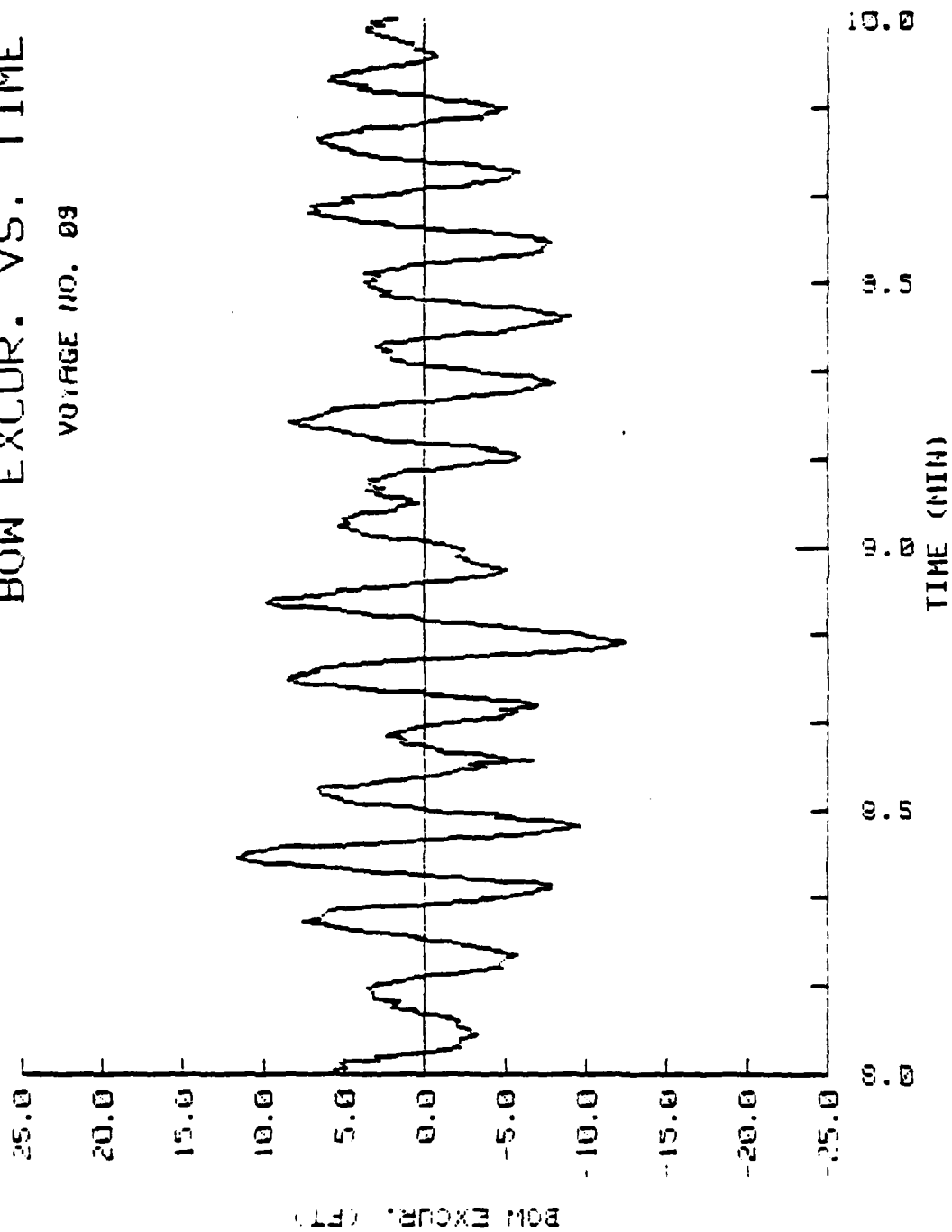
VOYAGE NO. 09





# BOW EXCUR. VS. TIME

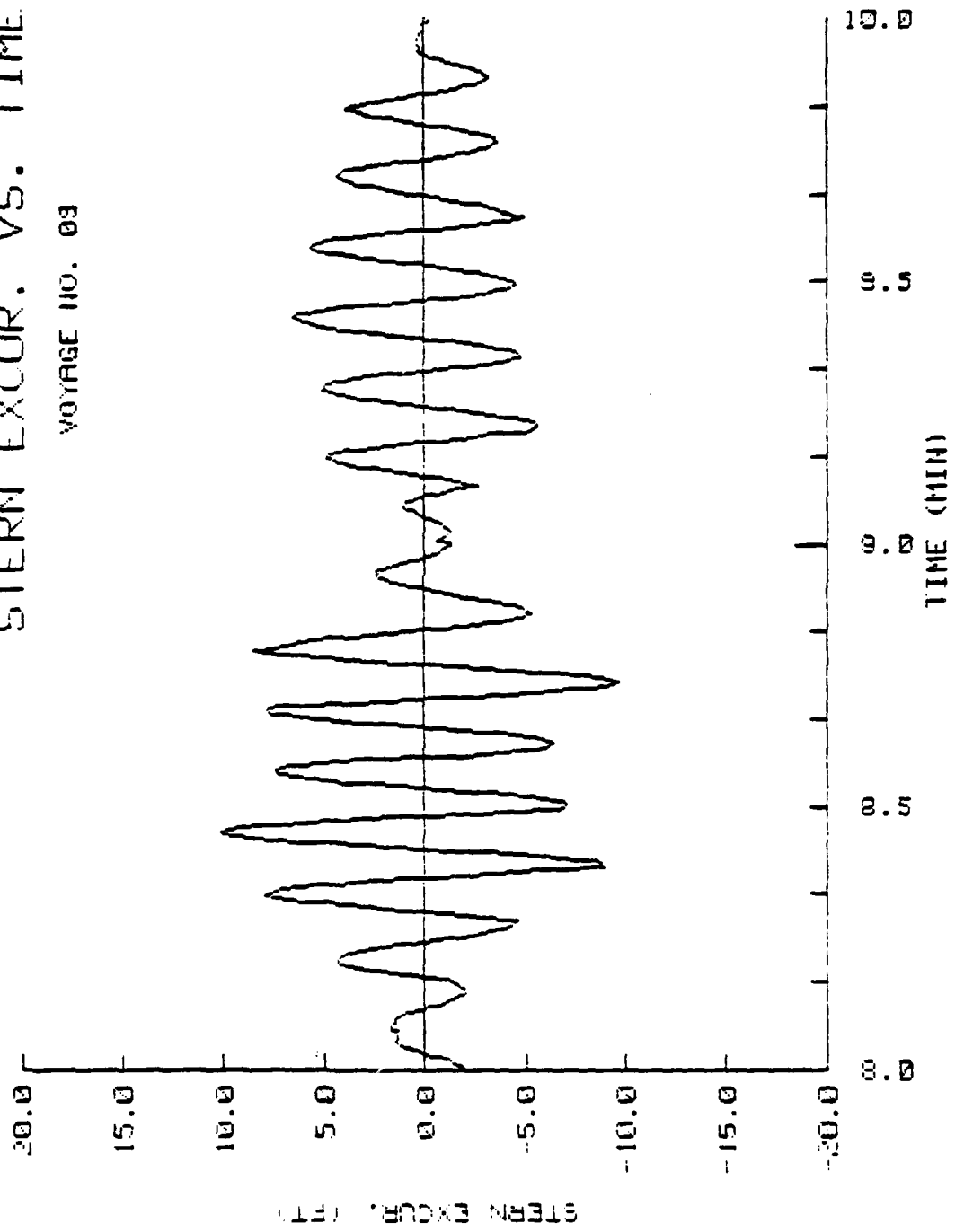
VOYAGE NO. 09





STERN EXCUR. VS. TIME

VOYAGE NO. 03





# STATISTICAL SUMMARY

VOYAGE NO. 10

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	.5	1.8	.7	.8
ROLL (DEG)	1.0	3.8	1.3	1.5
ACC (FT/SEC/SEC)	.1	1.8	.7	.8
HEAVE (FT)	.0	5.5	2.0	2.3
ROW EXCUR. (FT)	.0	15.0	5.3	6.2
STERN EXCUR. (FT)	.0	5.0	2.0	2.3
SIDE EXCUR (FT)	.0	5.9	2.3	2.7



START 05:15

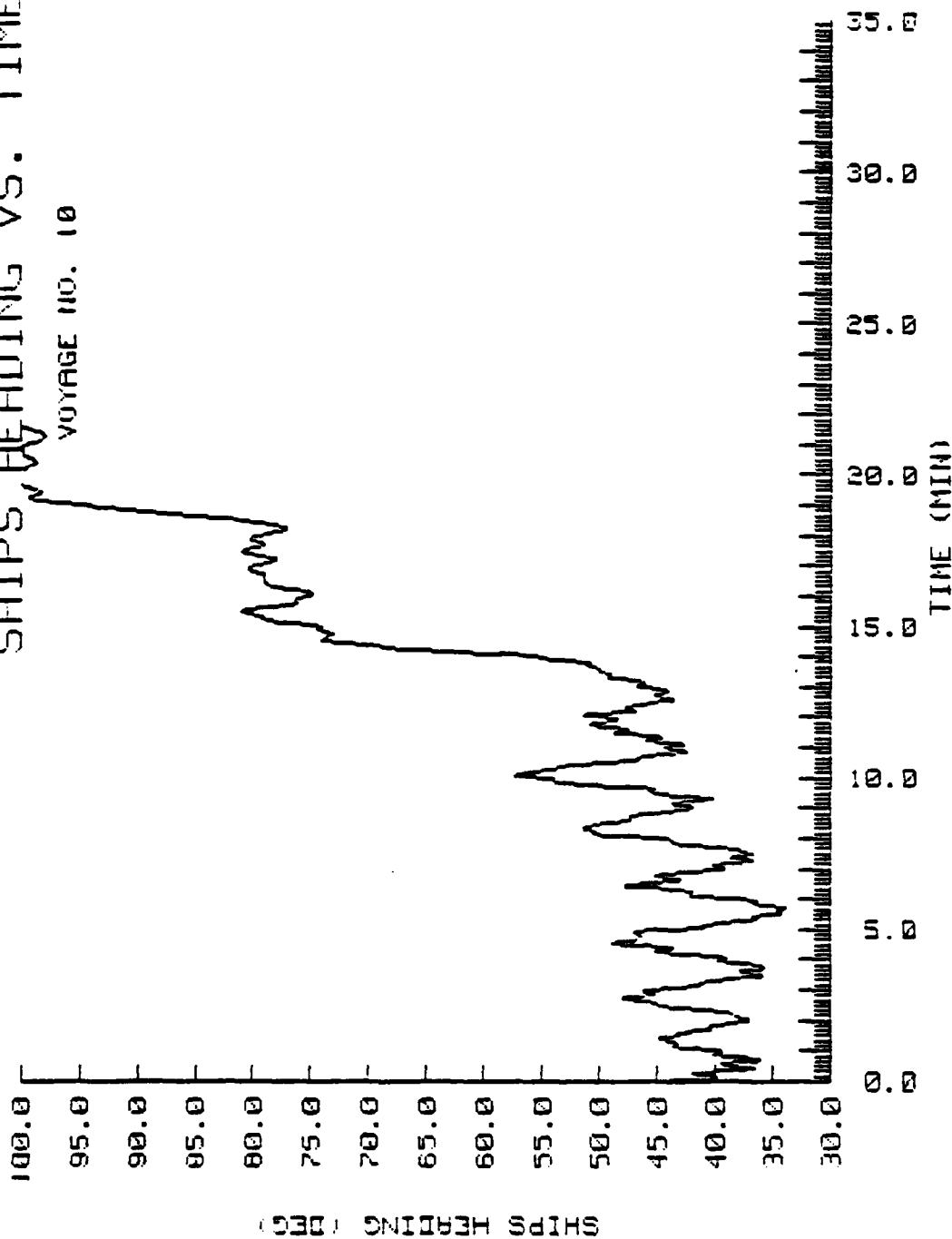
1  
2  
3  
4  
6  
7  
9  
11  
12

5000  
SOUNDINGS



# SHIPS HEADING VS. TIME

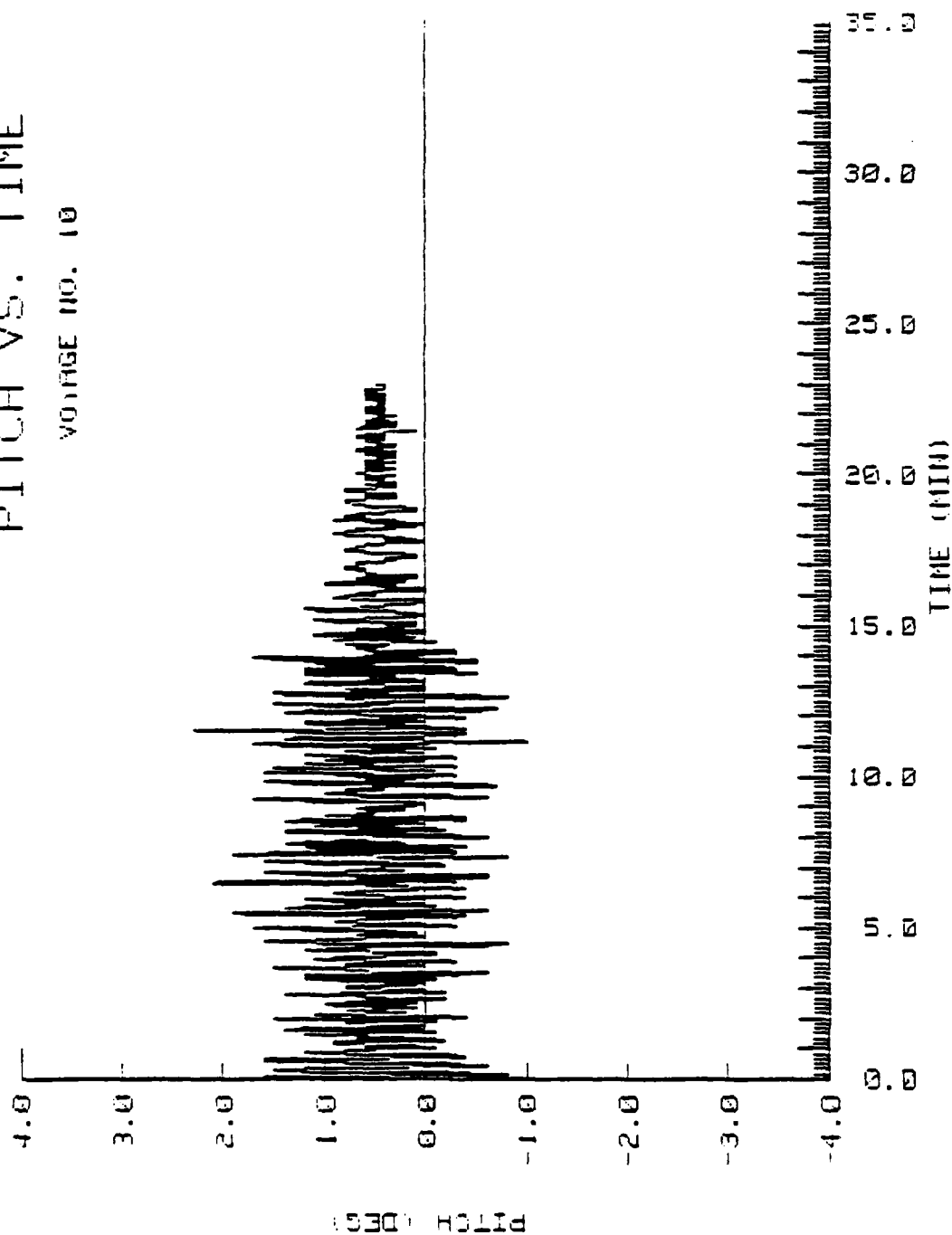
VOYAGE NO. 10





# PITCH VS. TIME

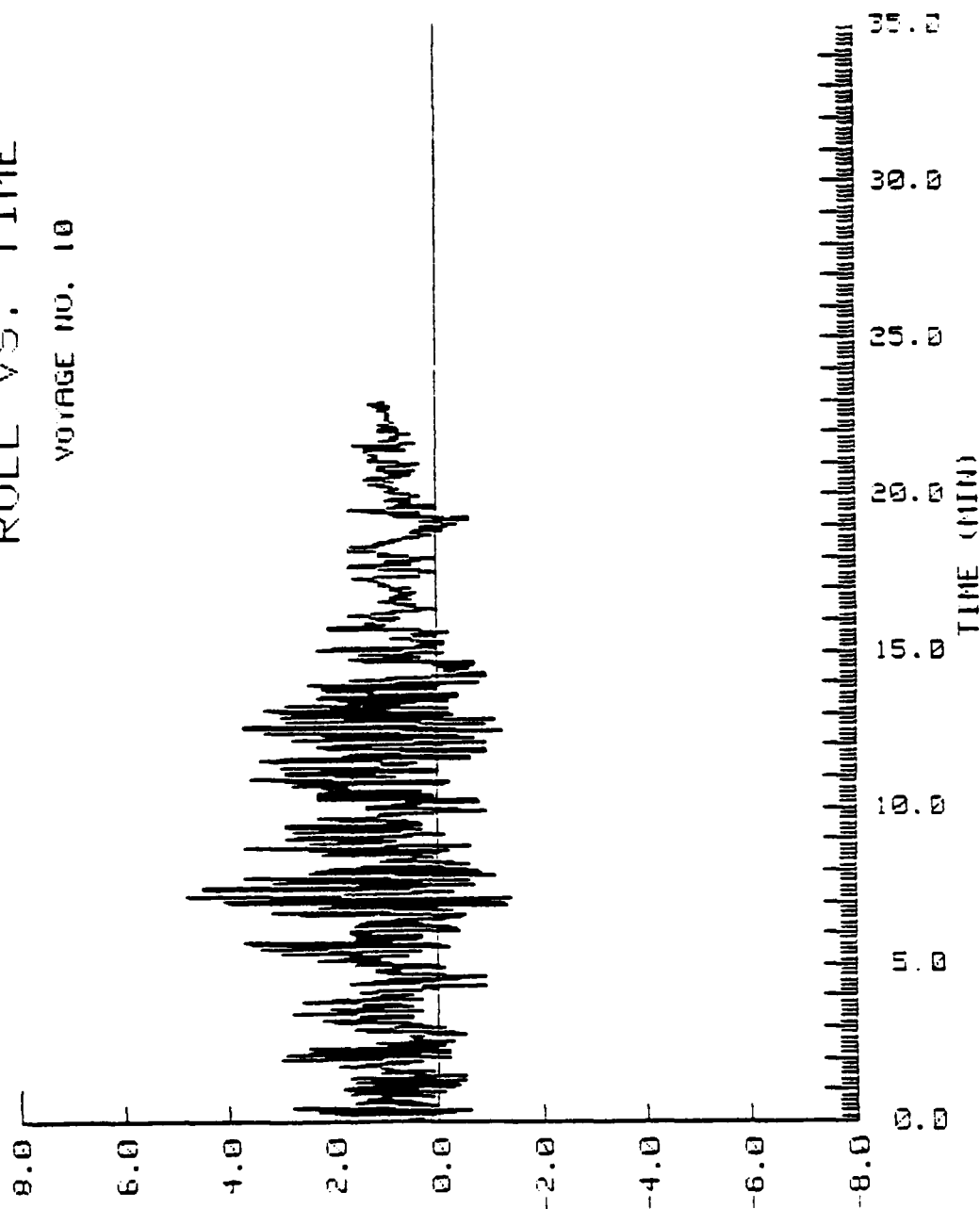
VOICE NO. 10





# ROLL VS. TIME

VOTAGE NO. 10

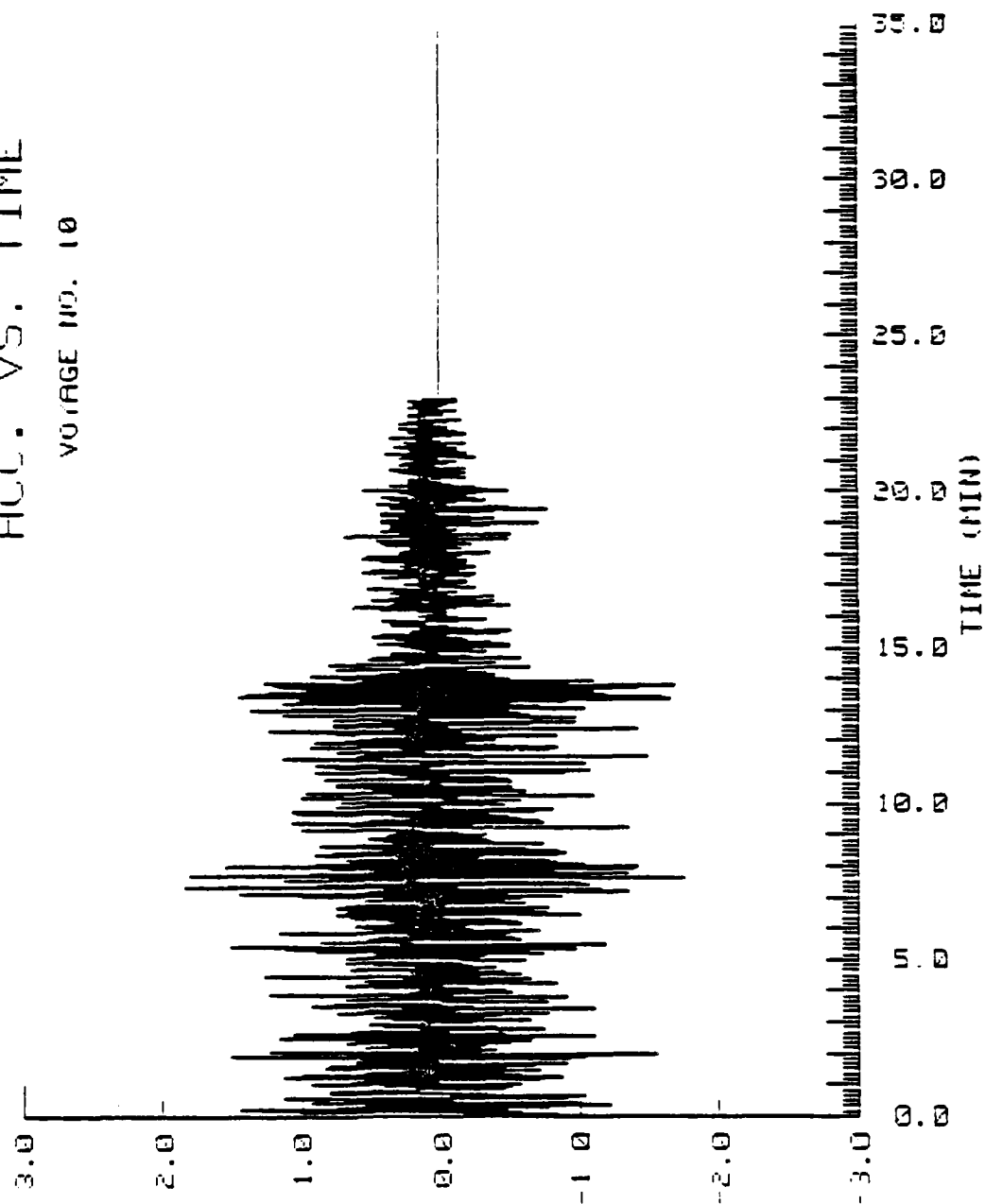


(930) 7708



ACC. VS. TIME

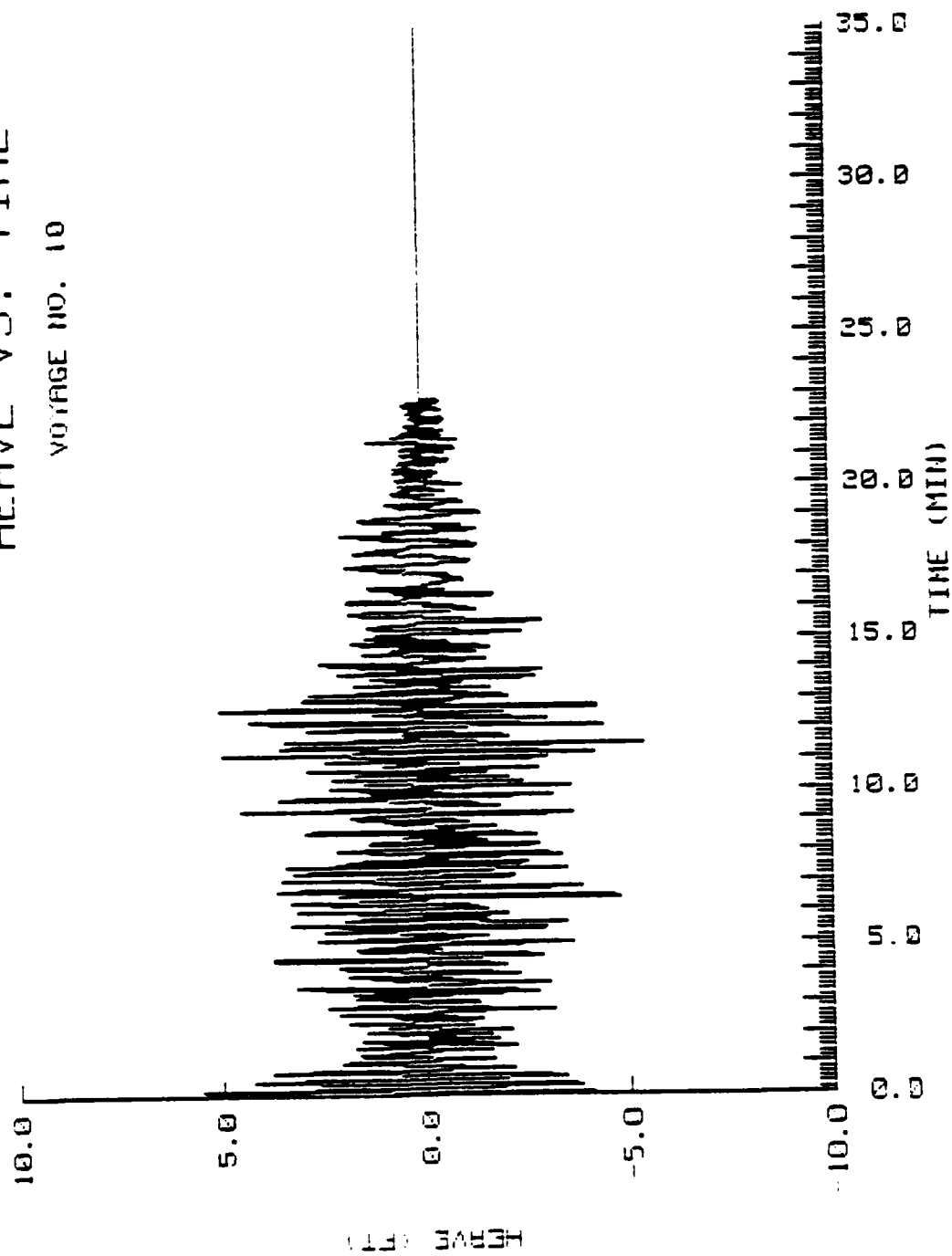
VOLTAGE 100. 10





# HEAVE VS. TIME

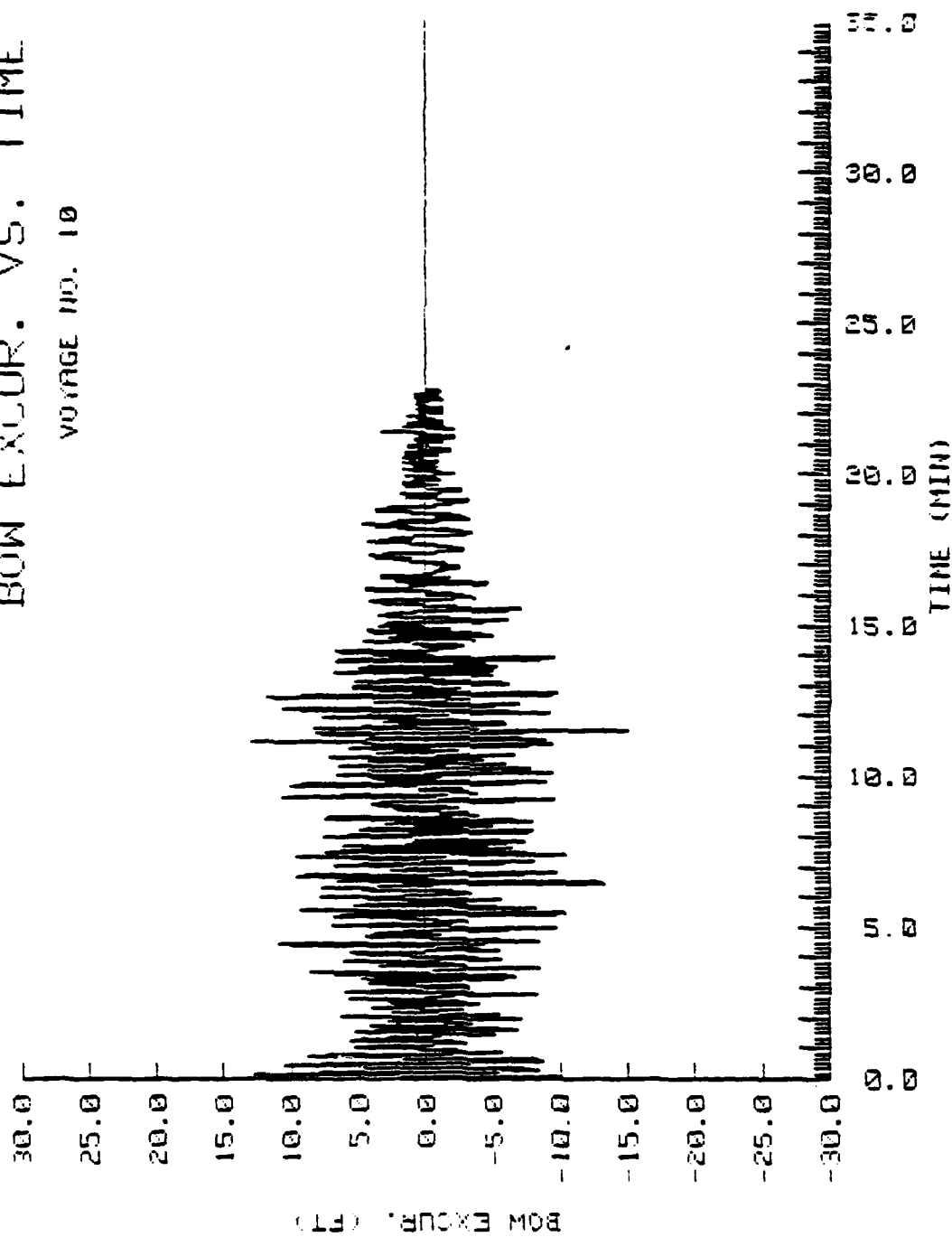
VOTAGE NO. 10





# BOW EXCUR. VS. TIME

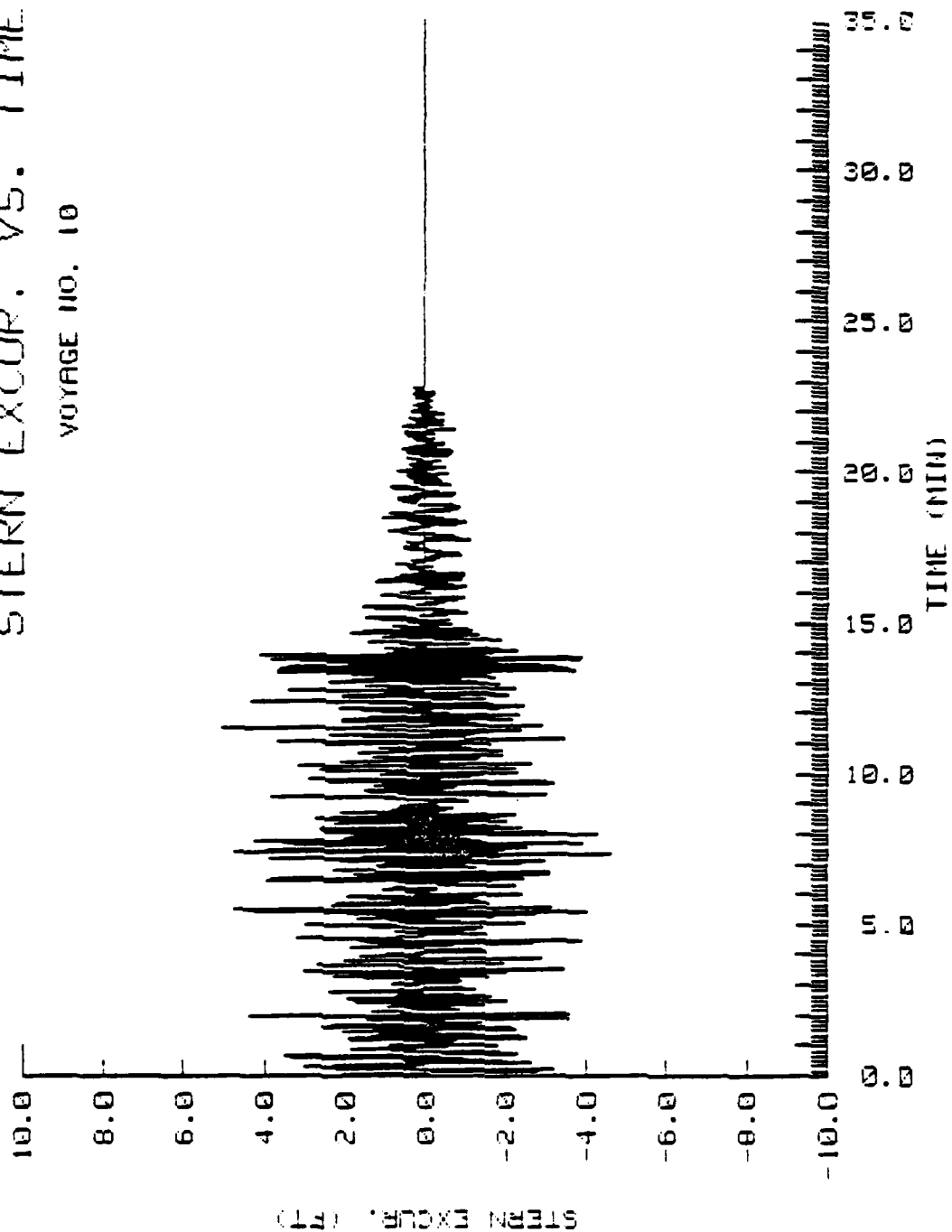
VOYAGE NO. 10





# STERN EXCUR. VS. TIME

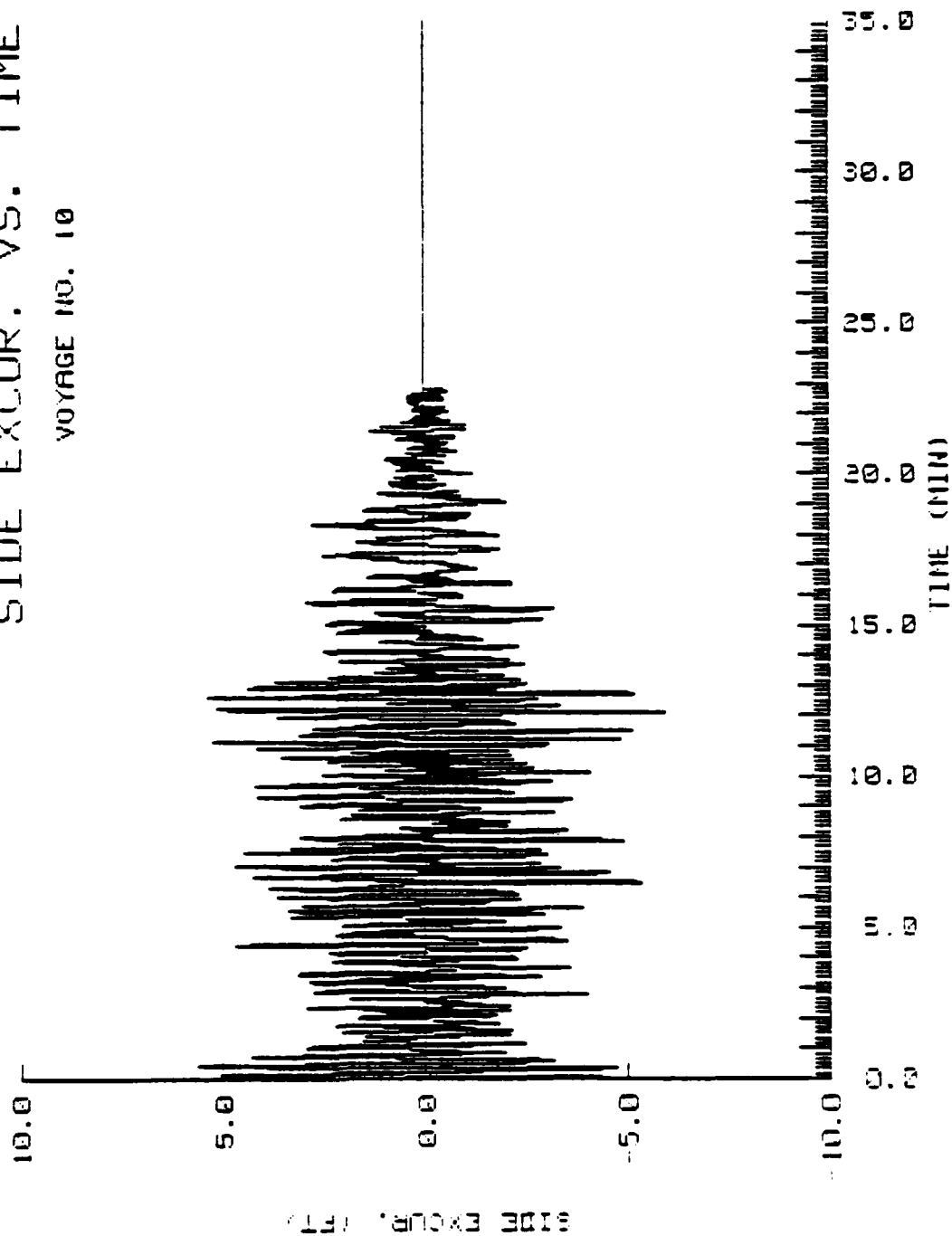
VOYAGE NO. 10





# SIDE EXCUR. VS. TIME

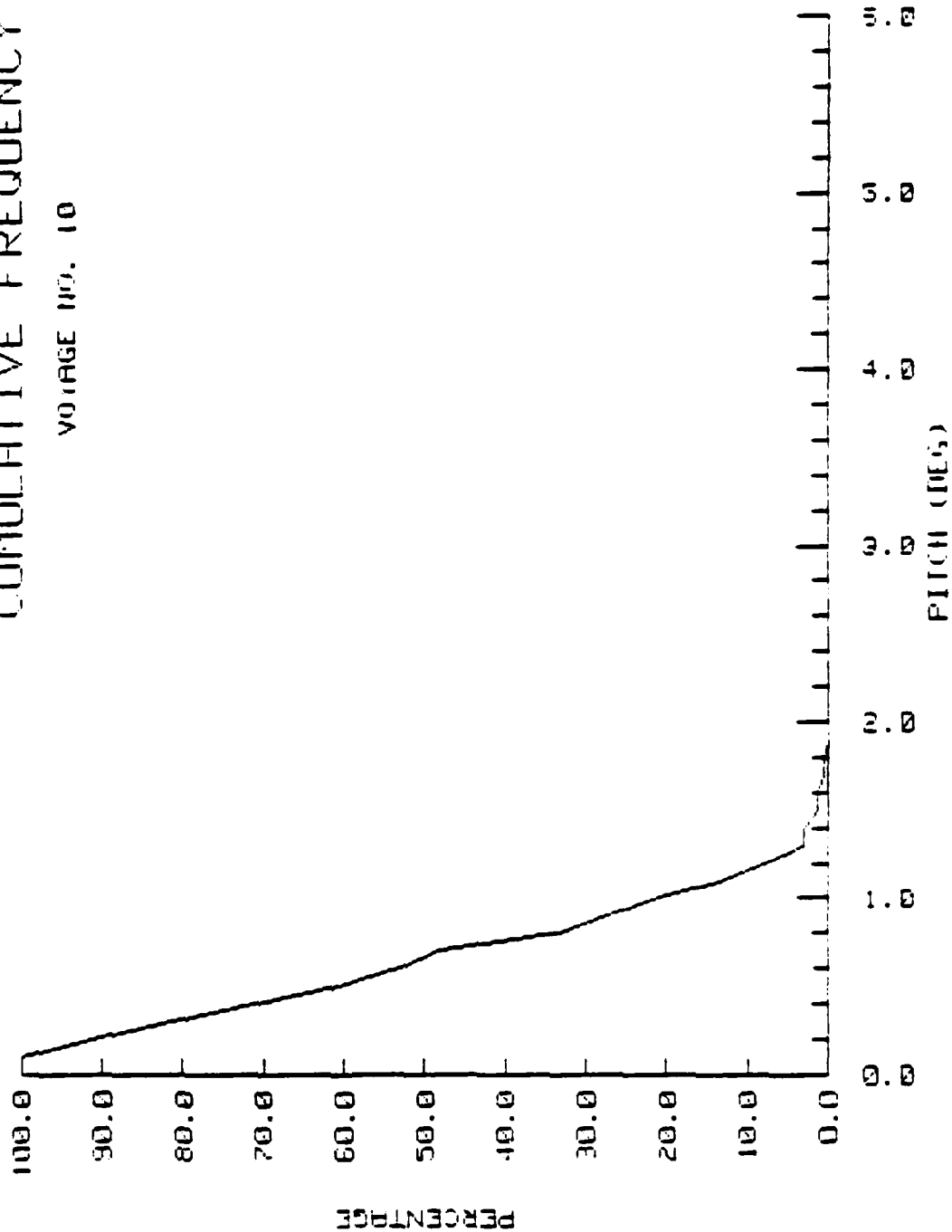
VOYAGE NO. 10





# CUMULATIVE FREQUENCY

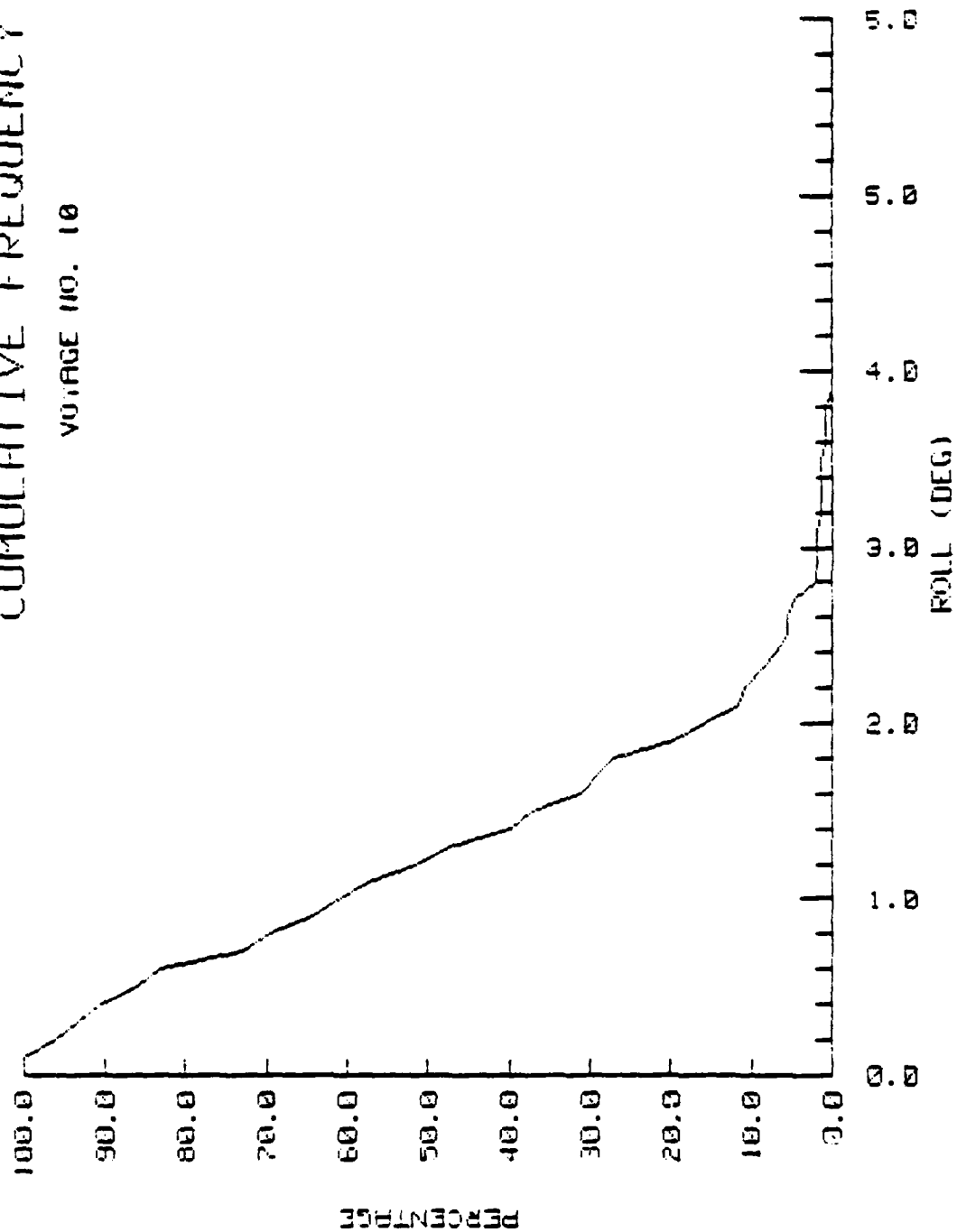
VOLAGE 110. 10





# CUMULATIVE FREQUENCY

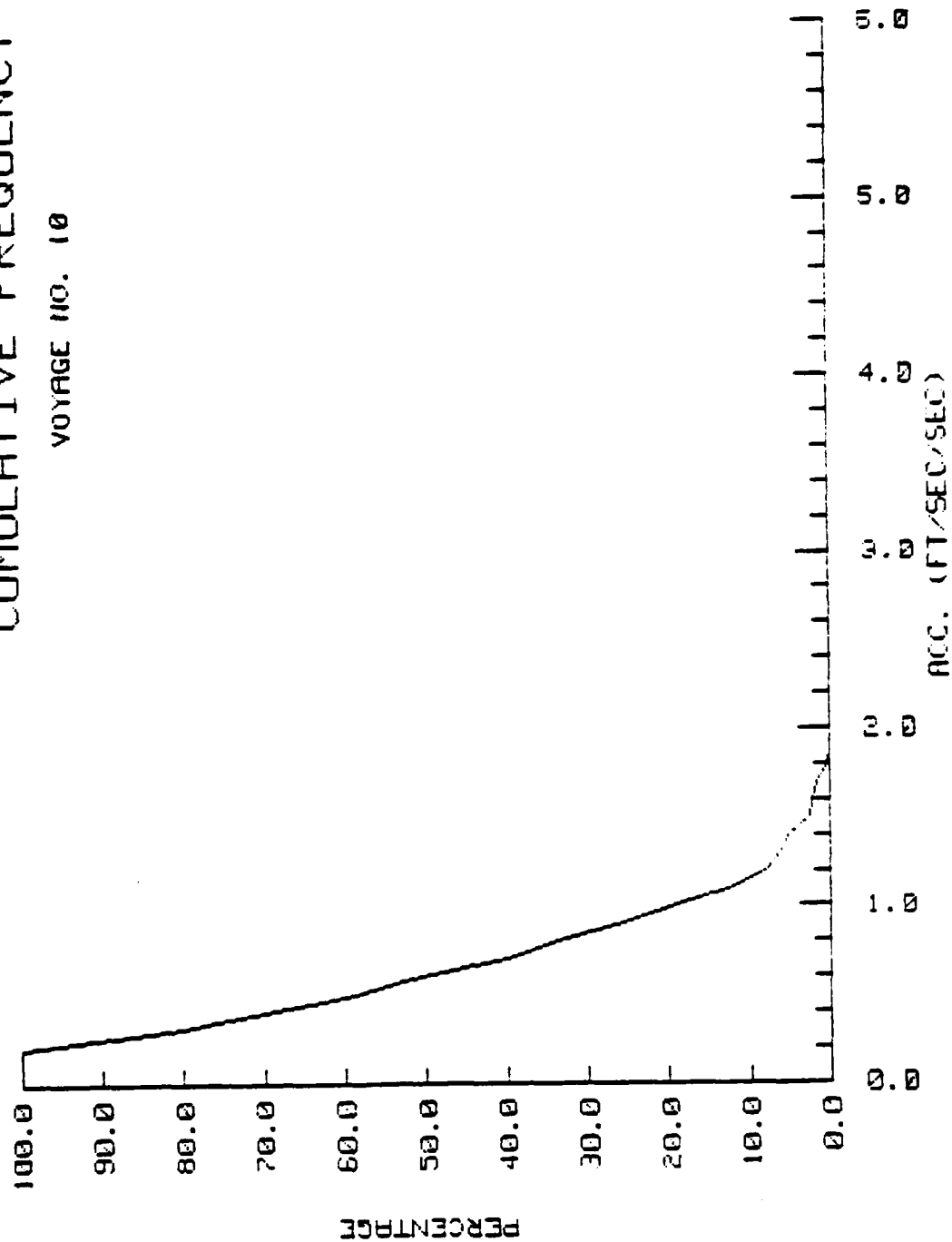
VOTAGE 110. 10





# CUMULATIVE FREQUENCY

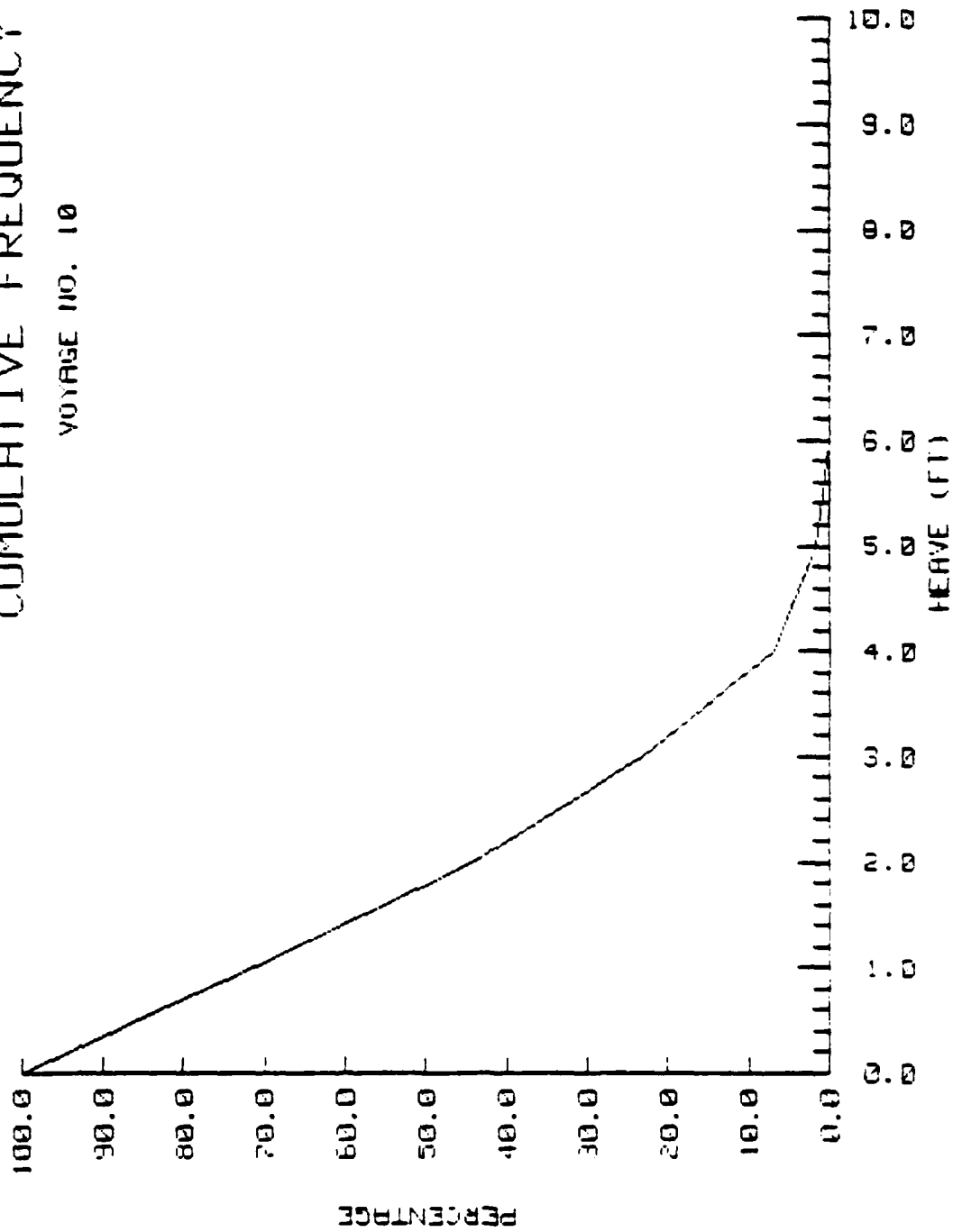
VOYAGE NO. 10





# CUMULATIVE FREQUENCY

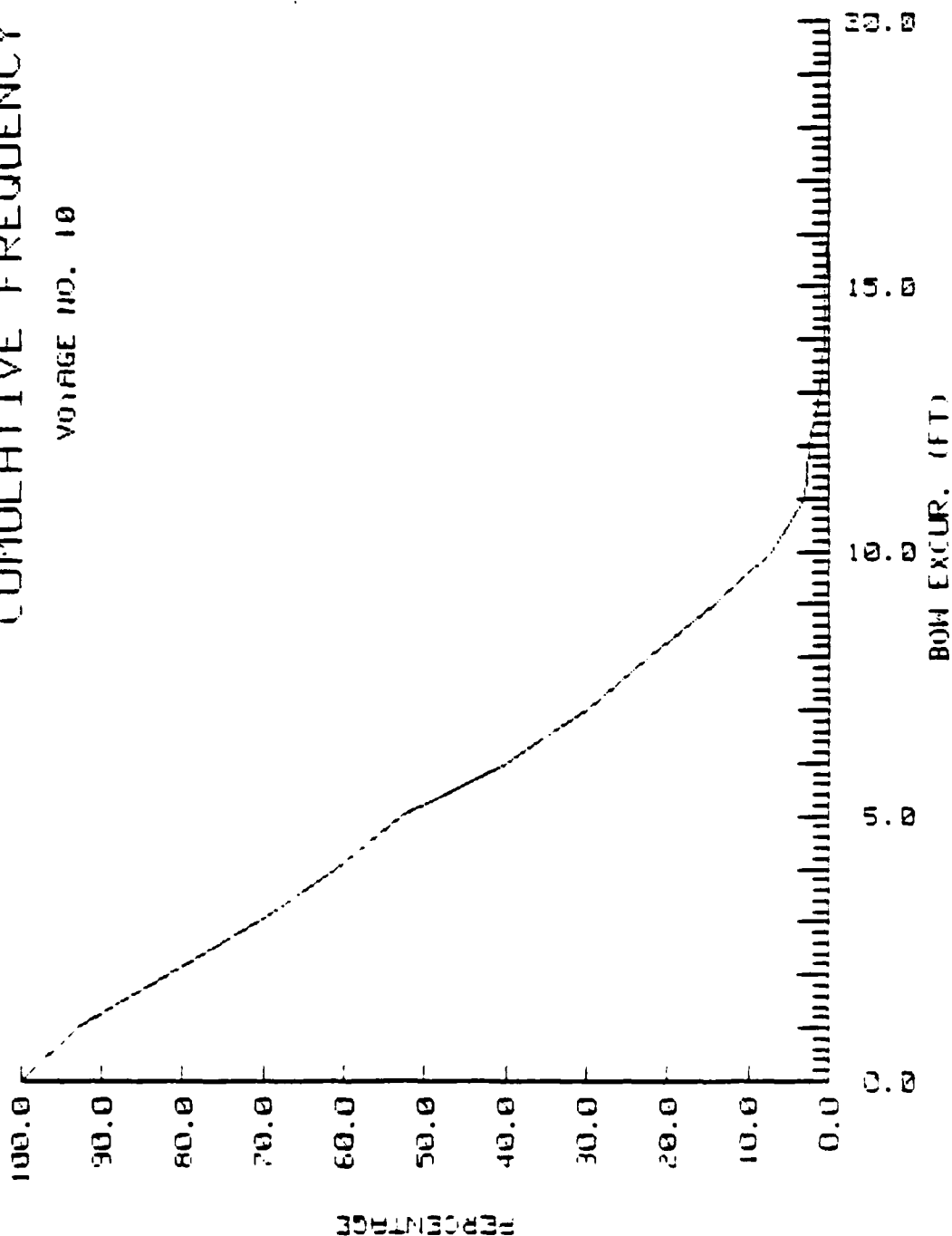
VOYAGE NO. 10





# CUMULATIVE FREQUENCY

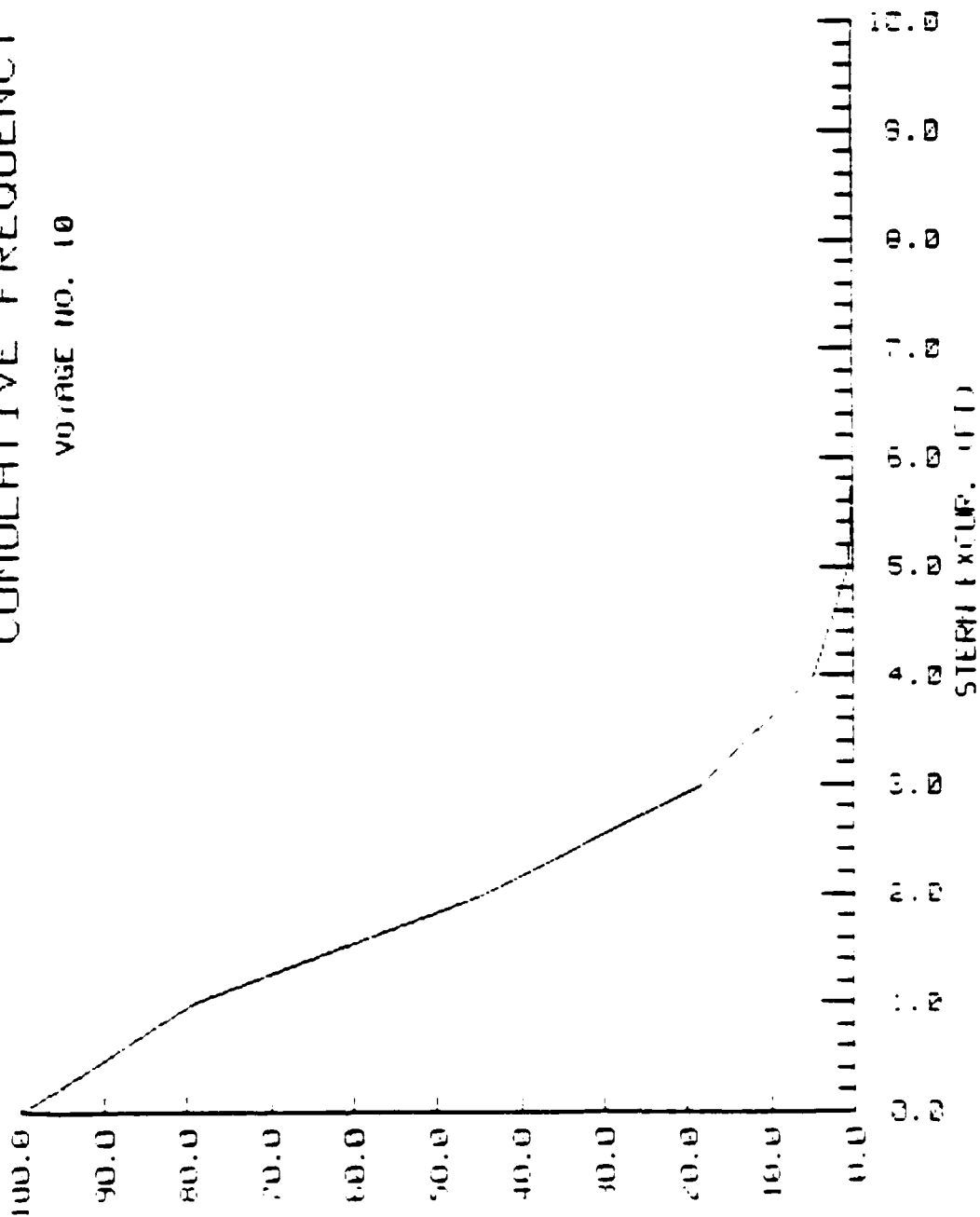
VOLAGE NO. 10





# CUMULATIVE FREQUENCY

VOLUME NO. 10



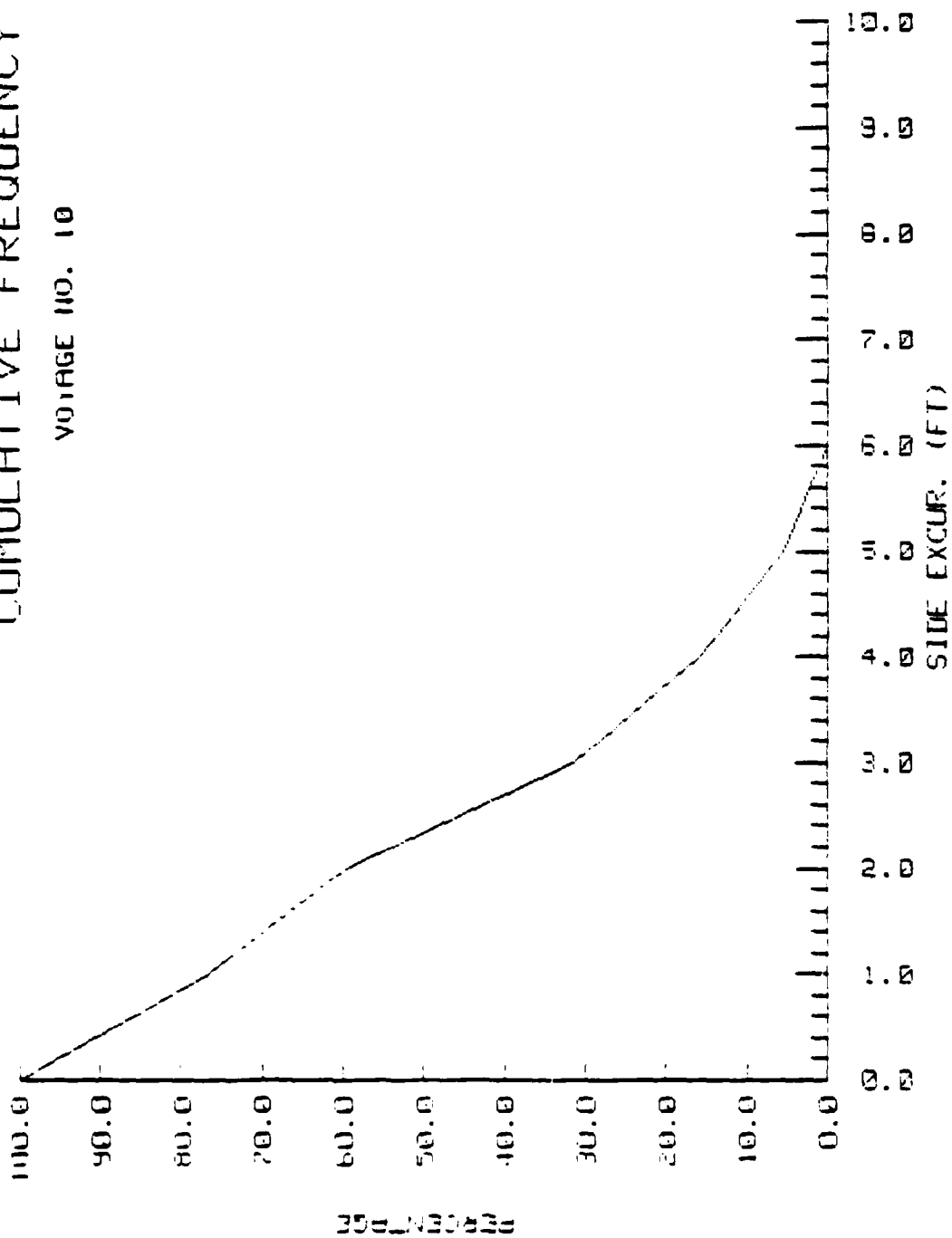
100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 0.0

STERIL EXPOS. (FD)



# CUMULATIVE FREQUENCY

VOIAGE NO. 10





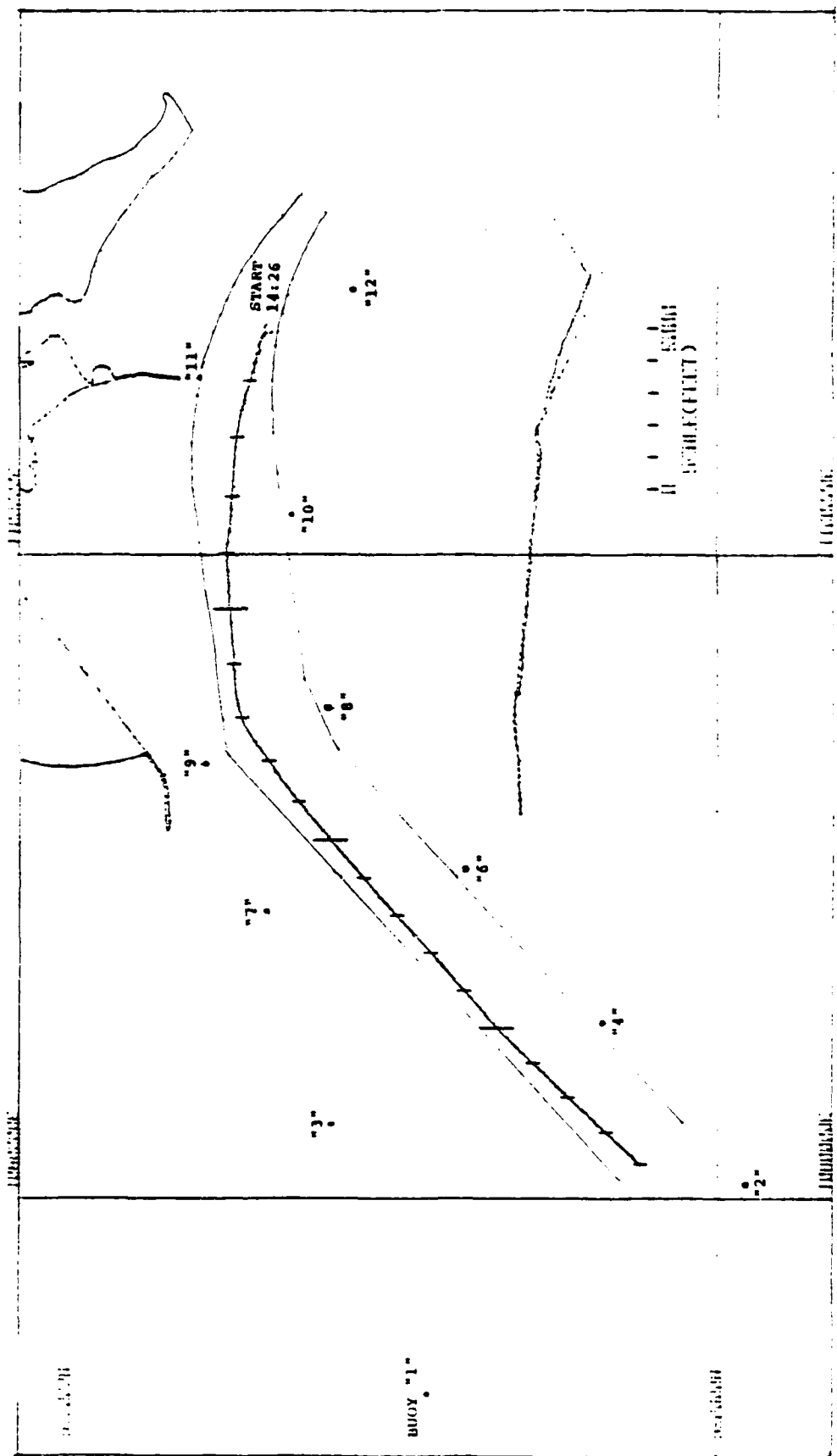
# STATISTICAL SUMMARY

VOYAGE NO. 11

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	.3	1.2	.5	.5
ROLL (DEG)	.8	2.1	.7	.8
ACC (FT/SEC/SEC)	.1	1.8	.9	1.0
HEAVE (FT)	-.0	4.5	2.0	2.2
BOW EXCUR. (FT)	-.0	10.6	4.2	4.7
STERN EXCUR. (FT)	-.0	3.6	1.8	1.9
SIDE EXCUR (FT)	-.0	4.3	1.9	2.1



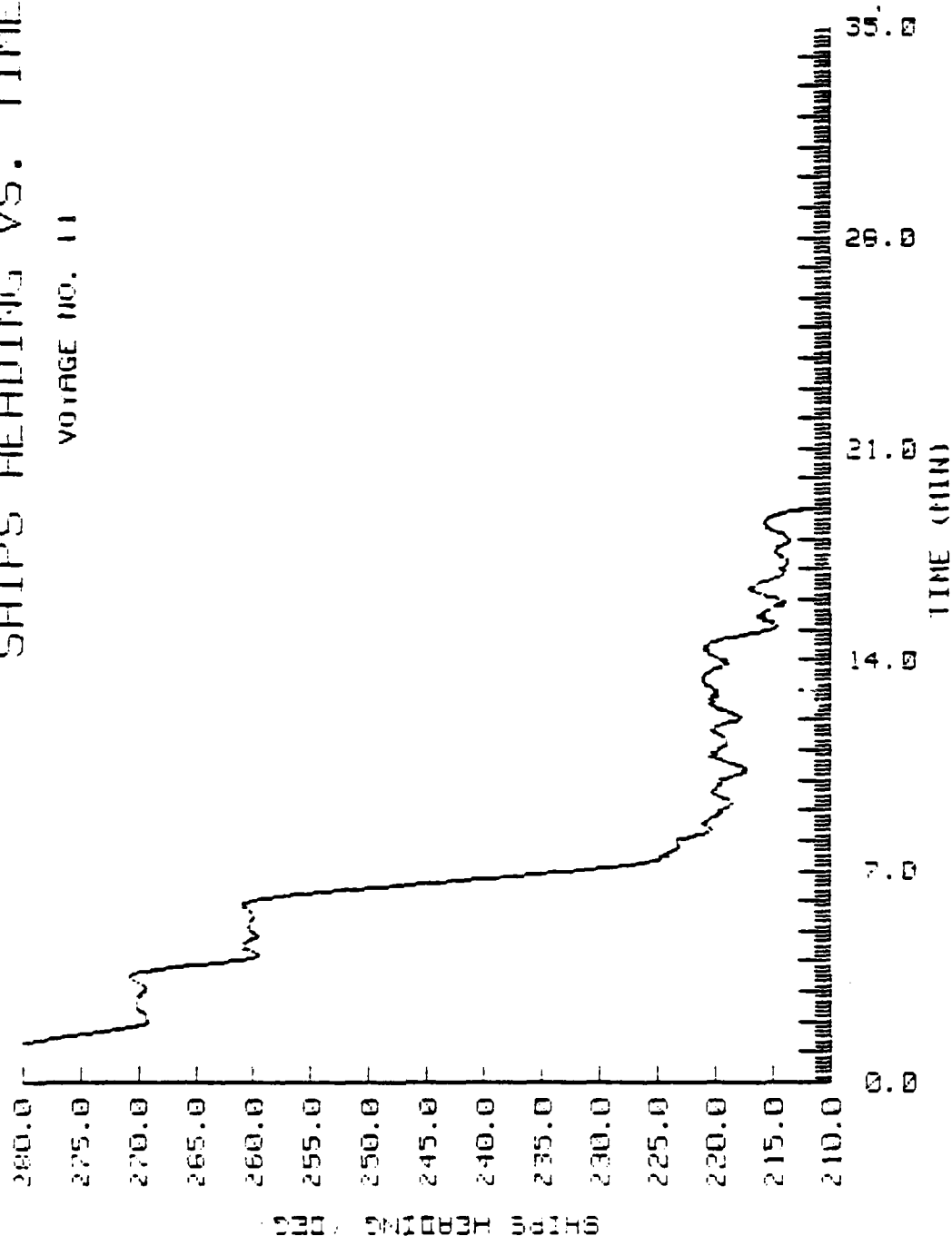
# WATER LEVEL RECORD 1900-1901





# SHIPS HEADING VS. TIME

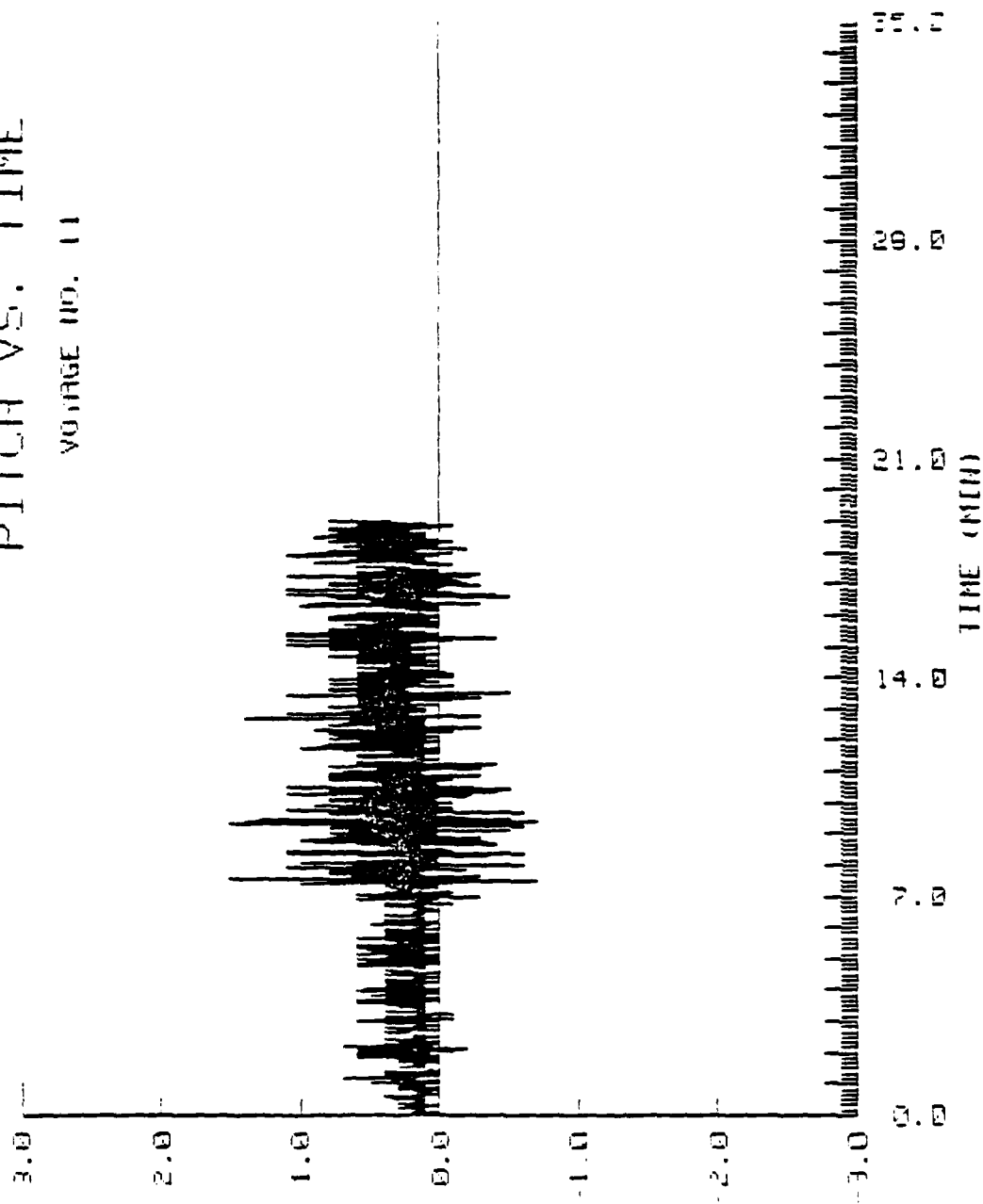
VOTAGE NO. 11





# PITCH VS. TIME

VOLUME NO. 11

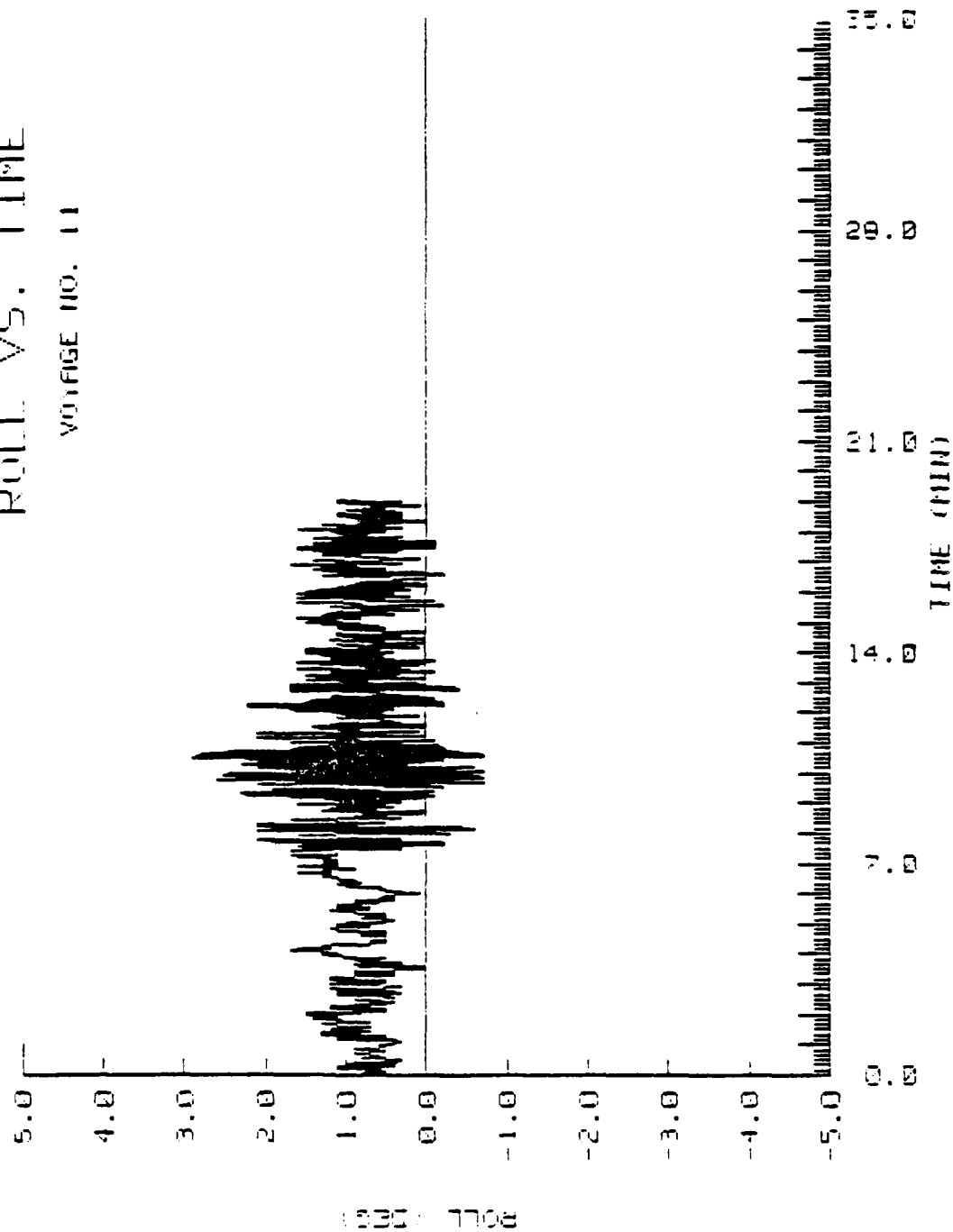


1000 - 10000



# ROLL VS. TIME

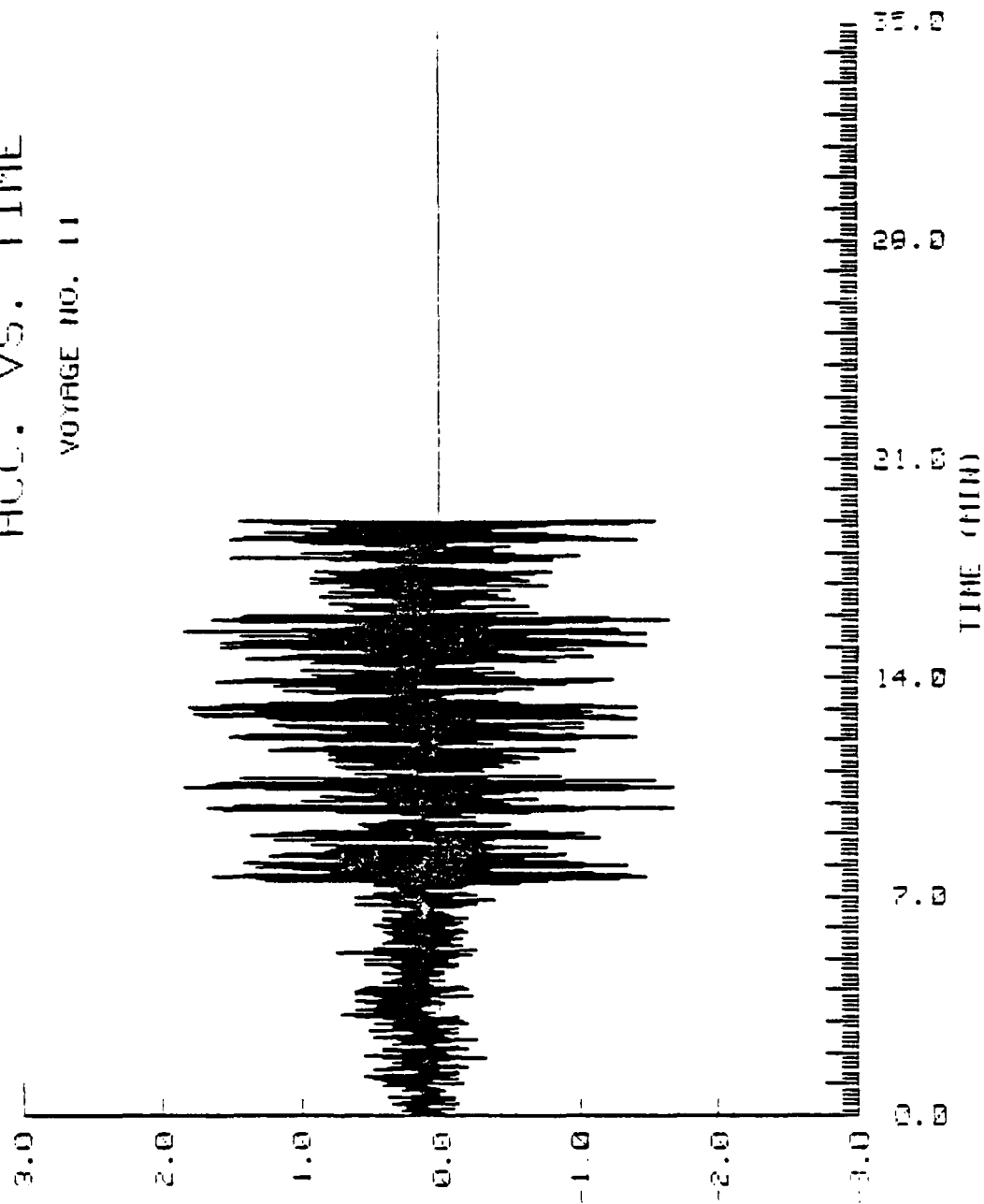
VOLTAJE NO. 11





ACC. VS. TIME

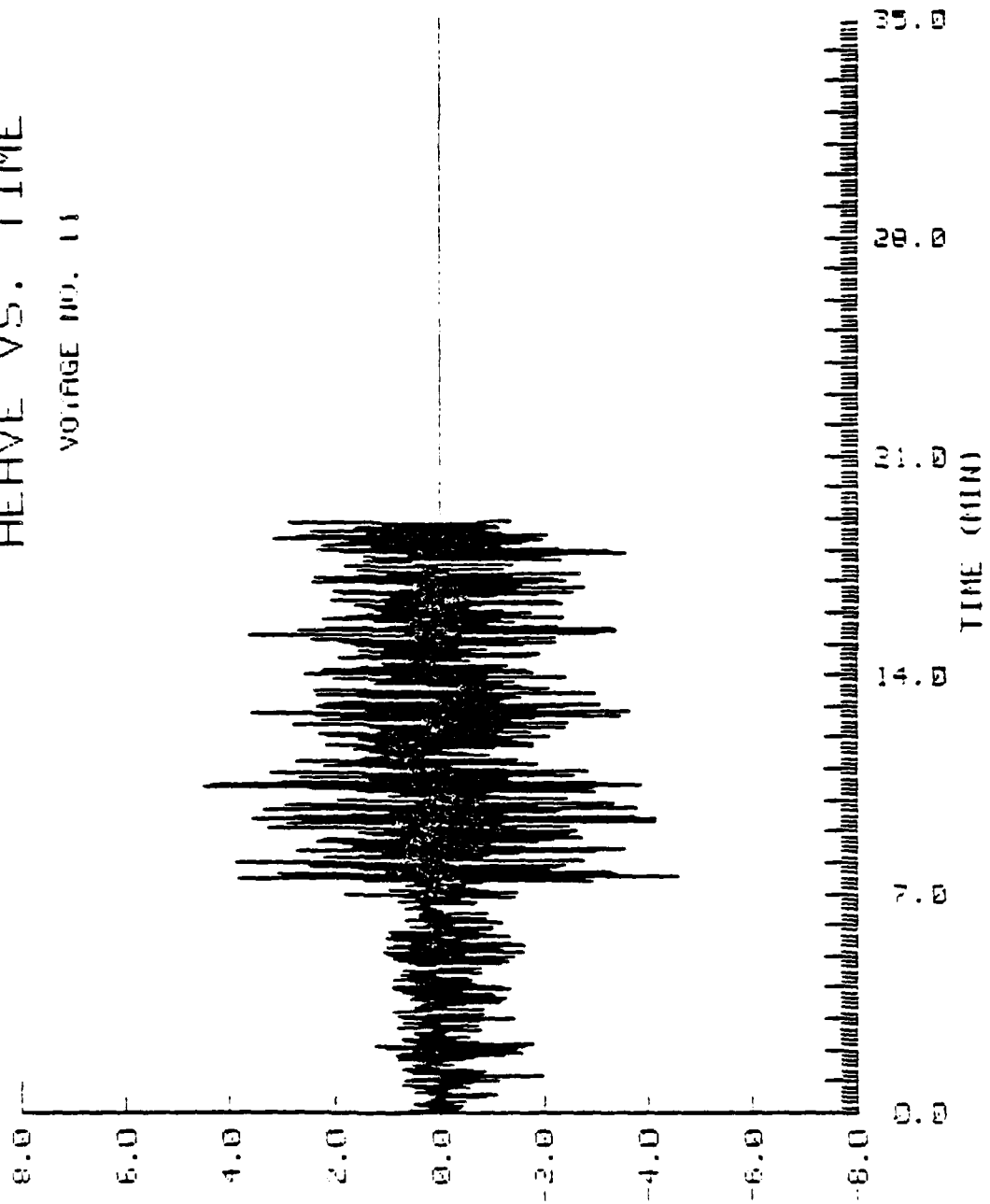
VOYAGE NO. 11





# HEAVE VS. TIME

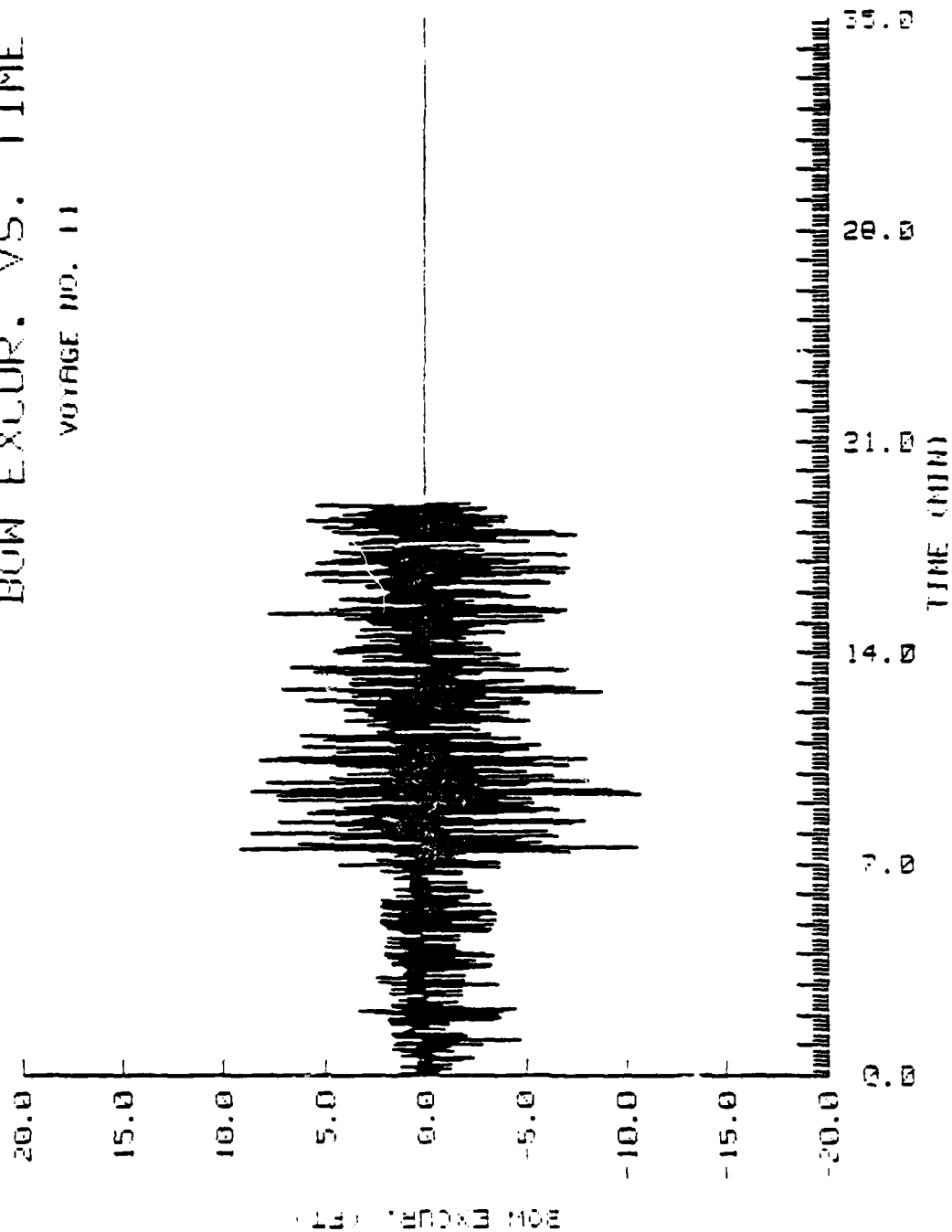
VOLTAGE NO. 11





# BOW EXCUR. VS. TIME

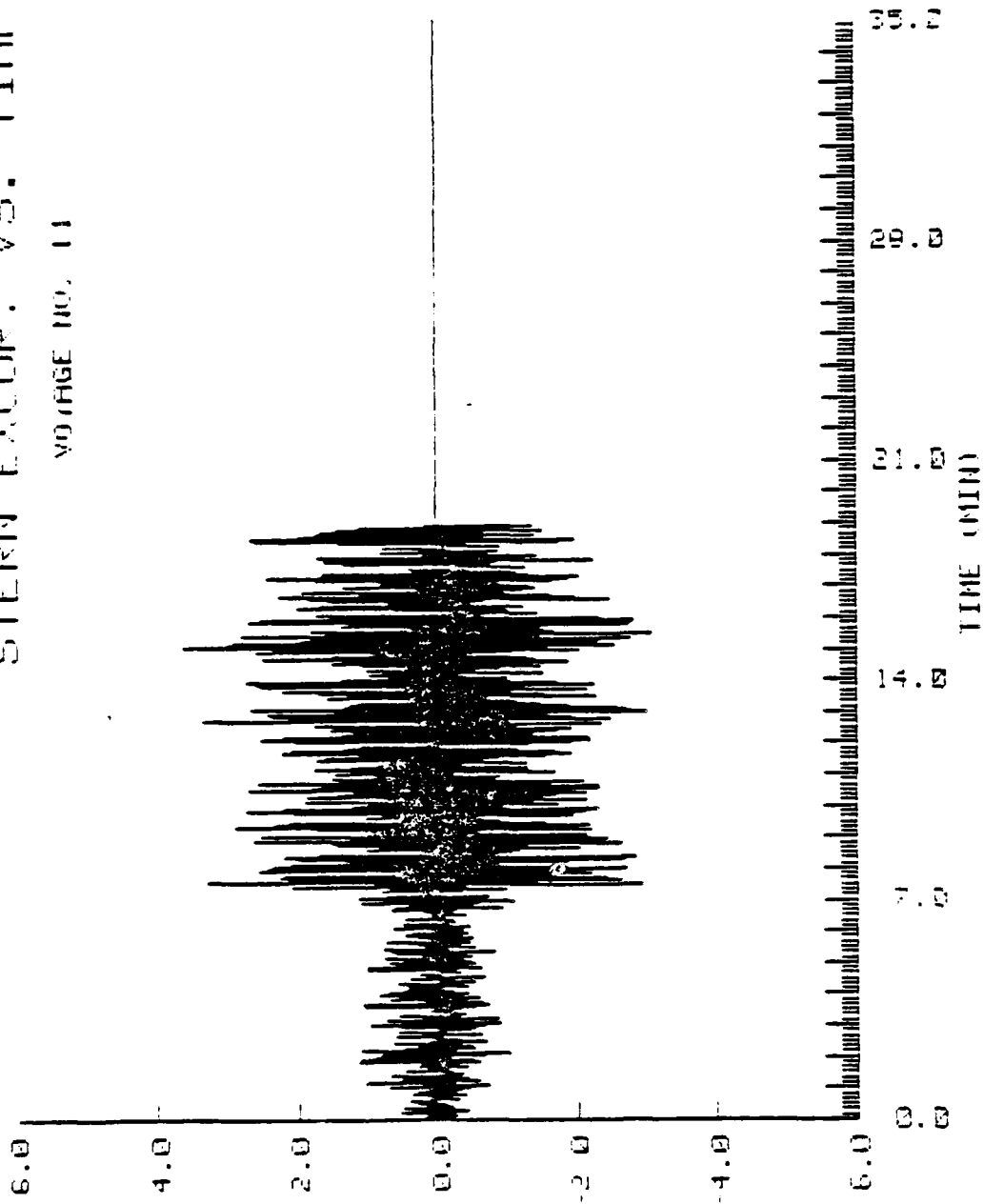
VOYAGE NO. 11





# SIERN EXCUR. VS. TIME

VOLTAJE NO. 11

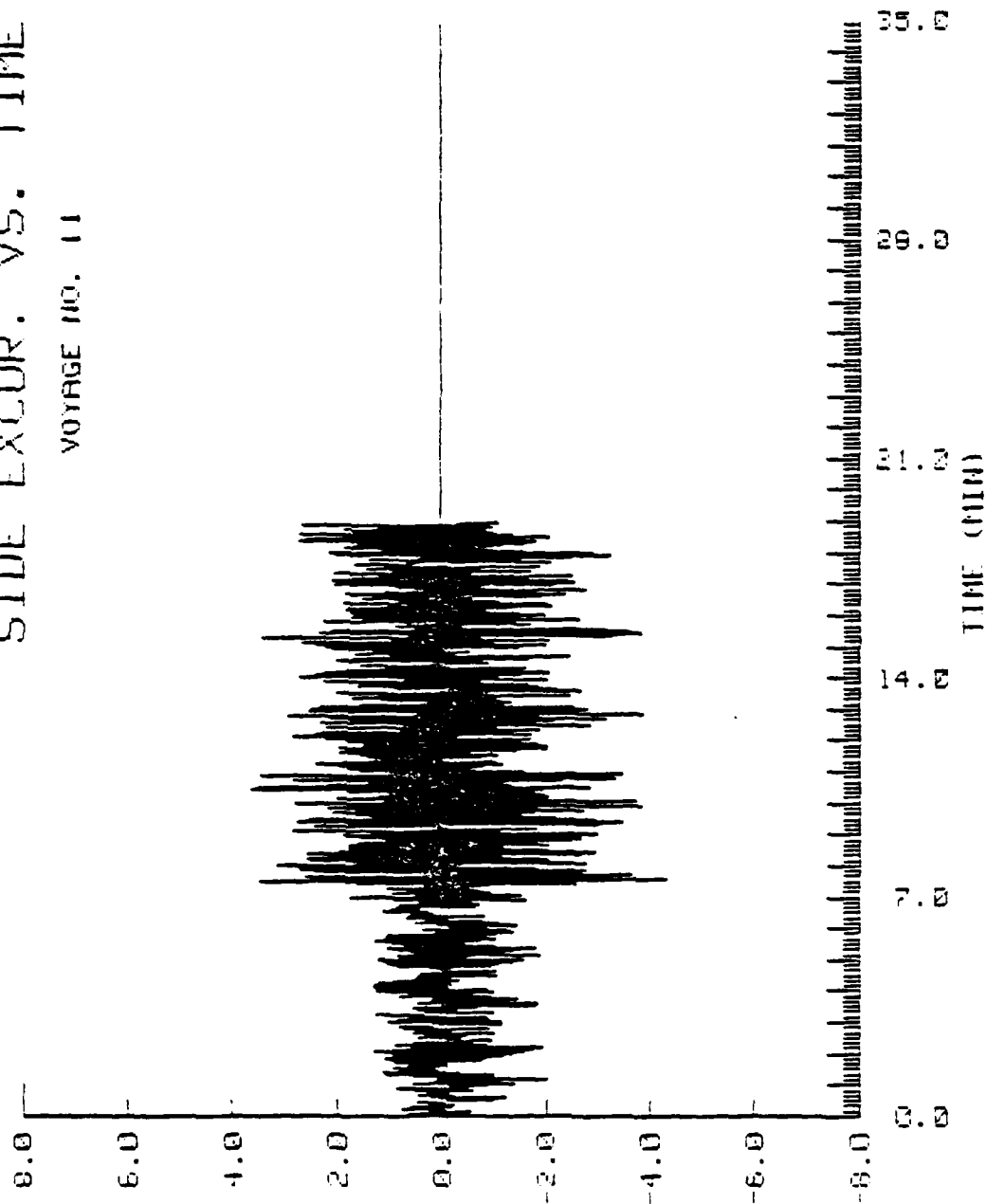


11-1-1970 83 22315



# SIDE EXCUR. VS. TIME

VOYAGE NO. 11

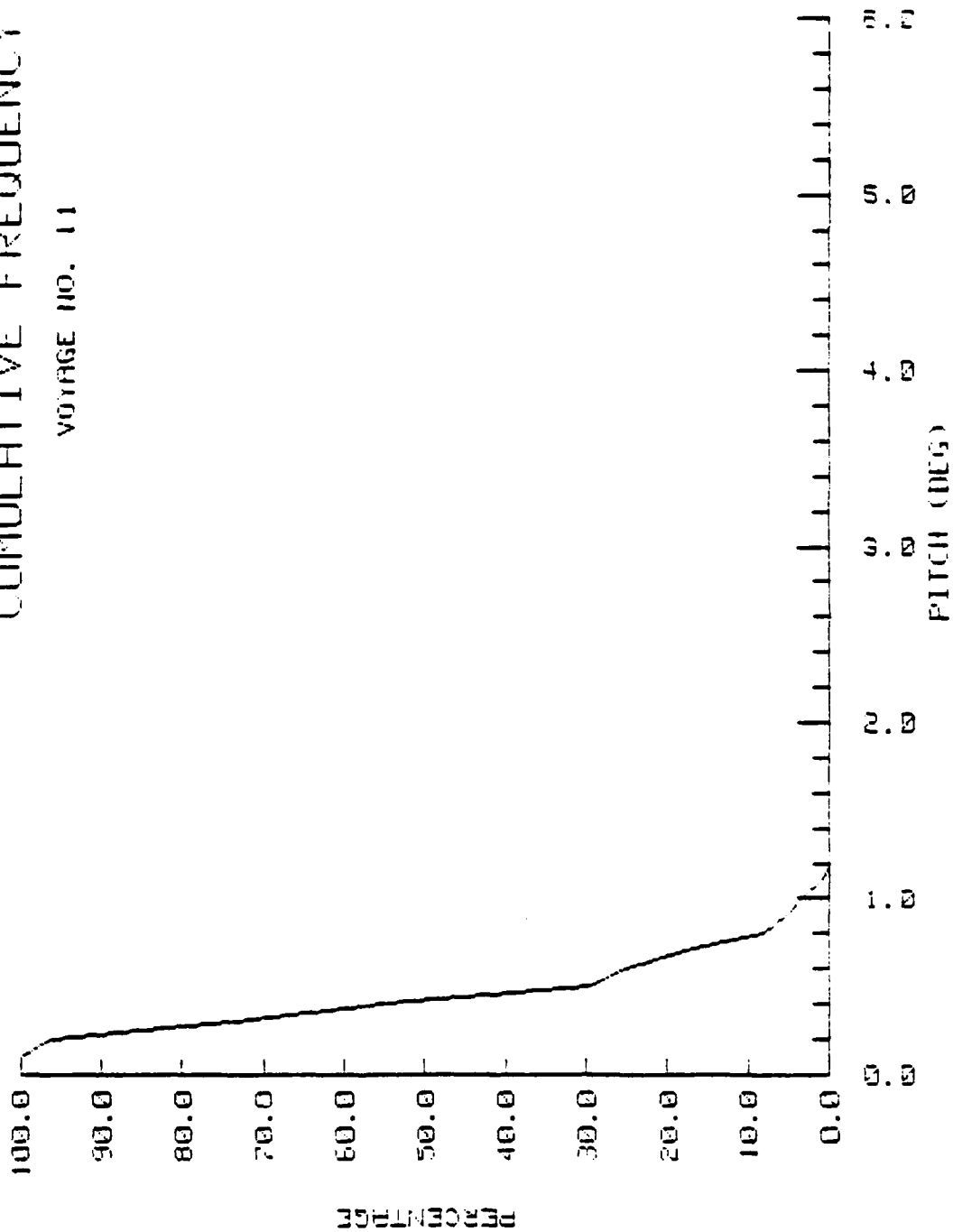


15. 100000 0010



# CUMULATIVE FREQUENCY

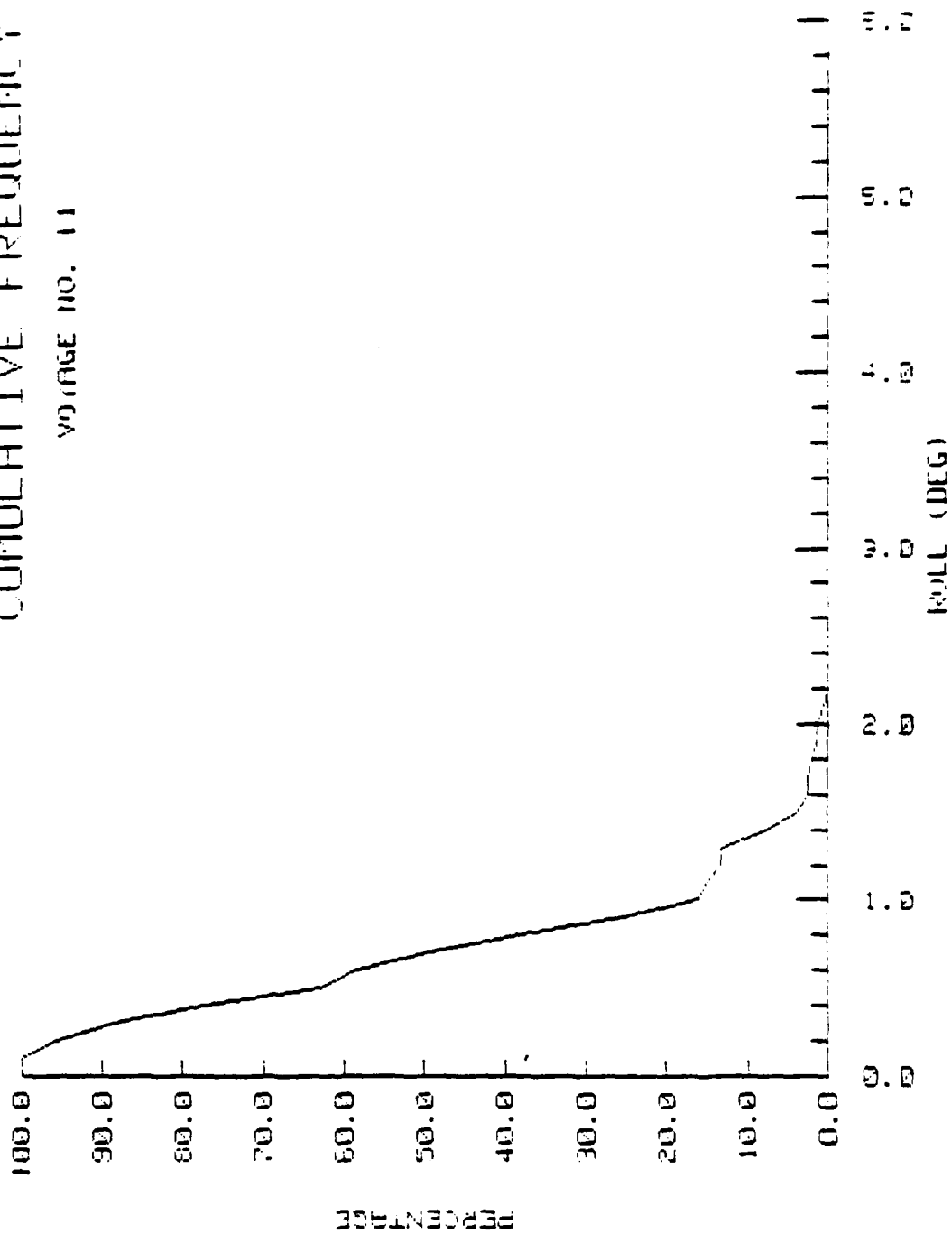
VOTAGE NO. 11





# CUMULATIVE FREQUENCY

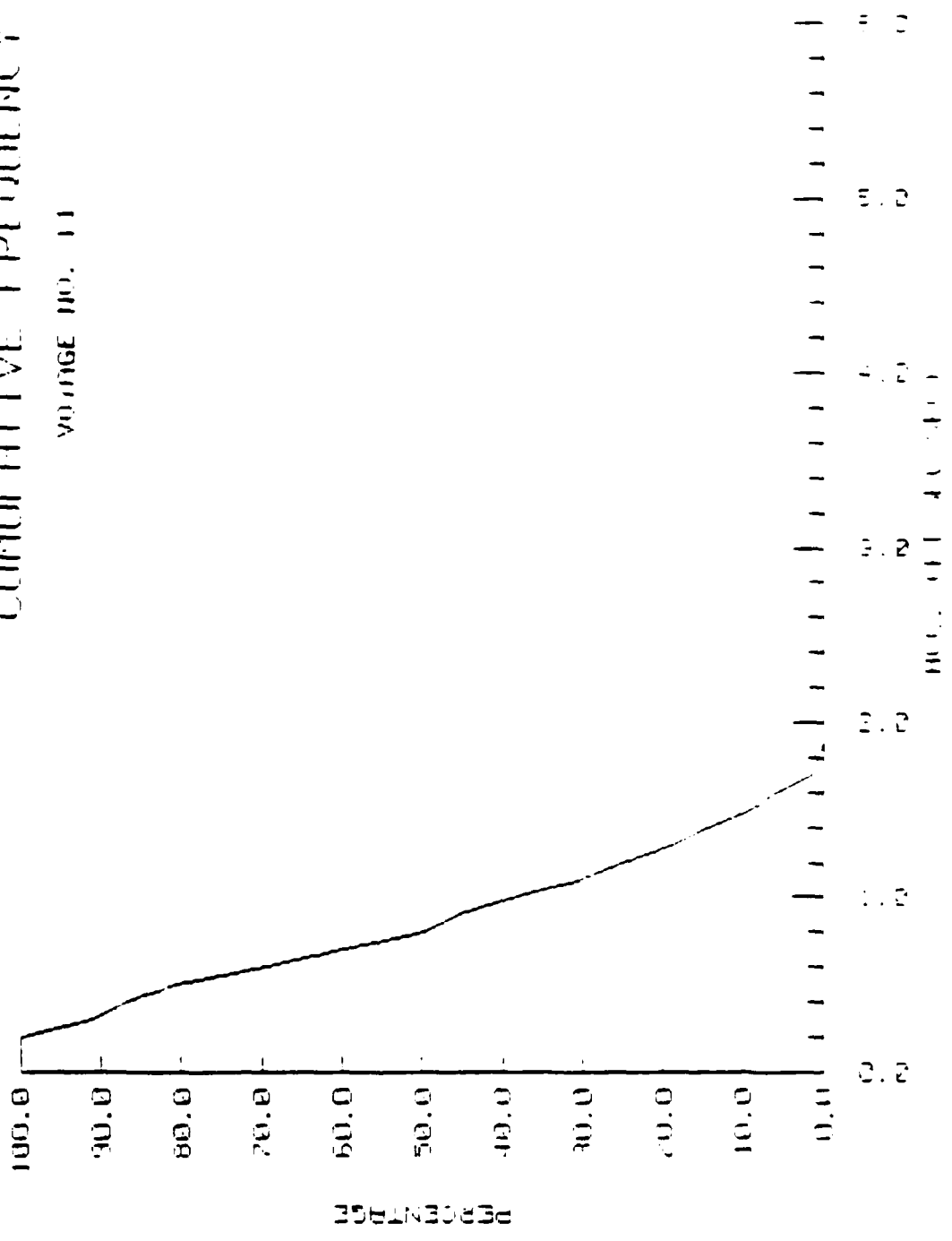
VOYAGE NO. 11





# CUMULATIVE FREQUENCY

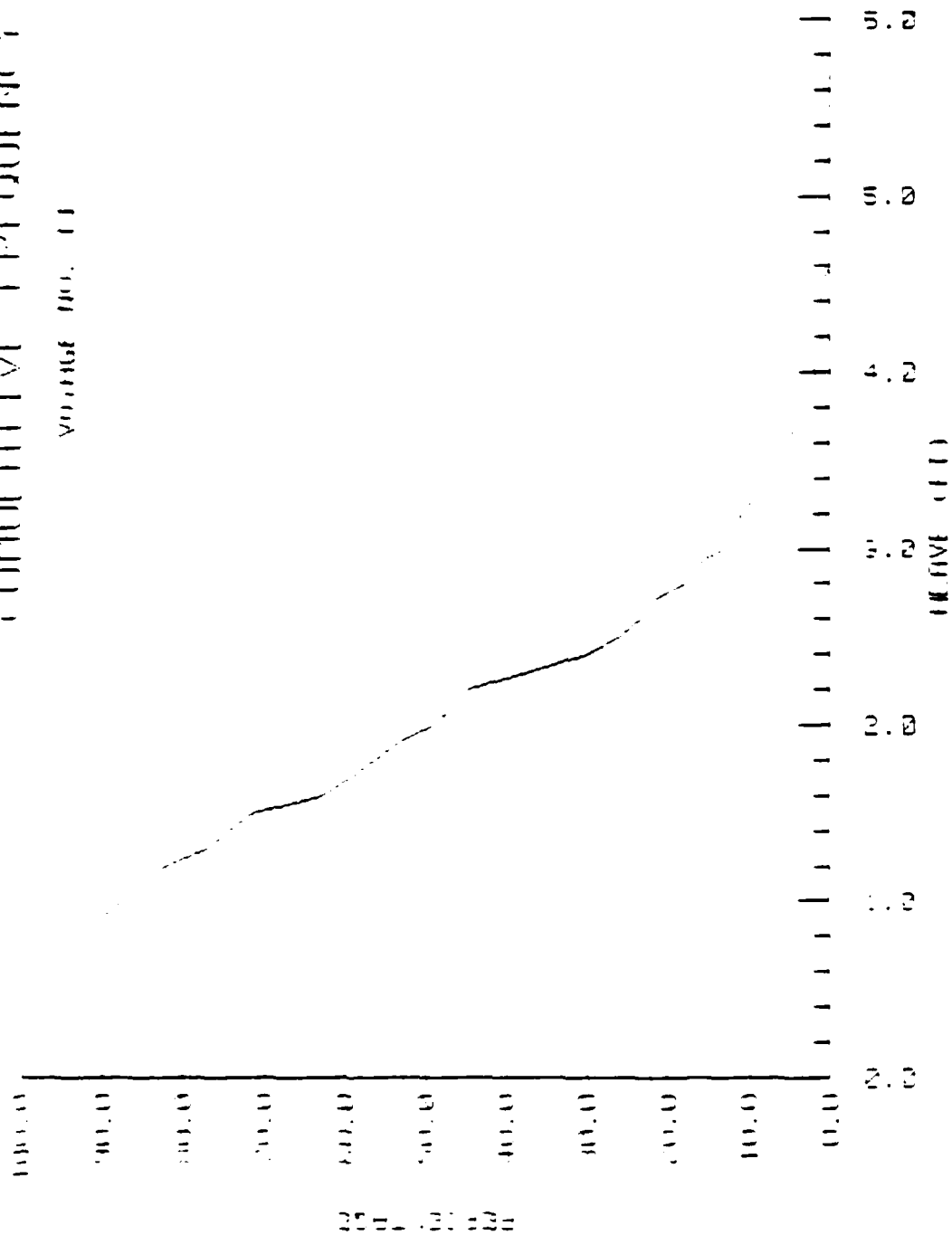
YOUNGE NO. 11





# PERCENTAGE OF

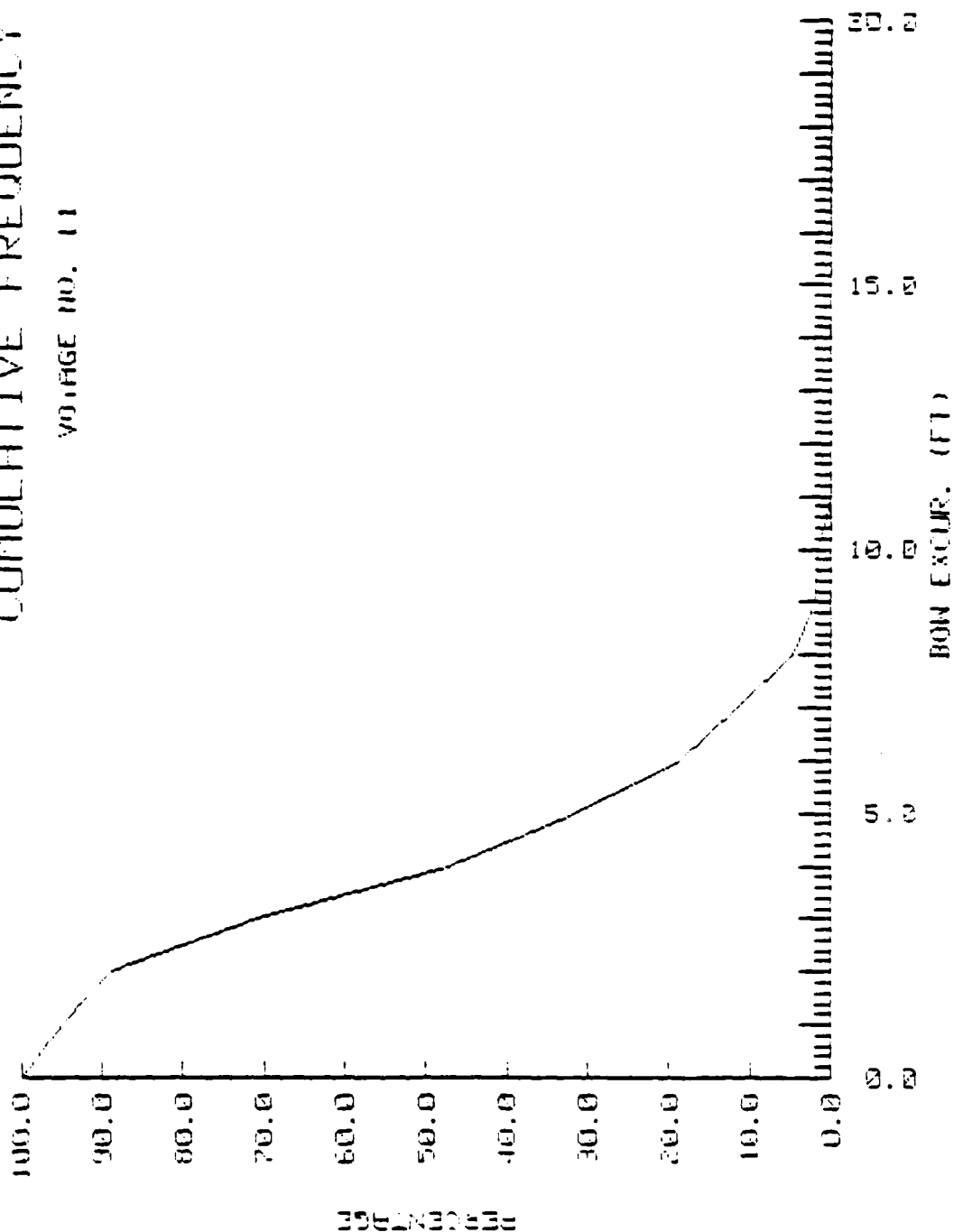
WATER





# CUMULATIVE FREQUENCY

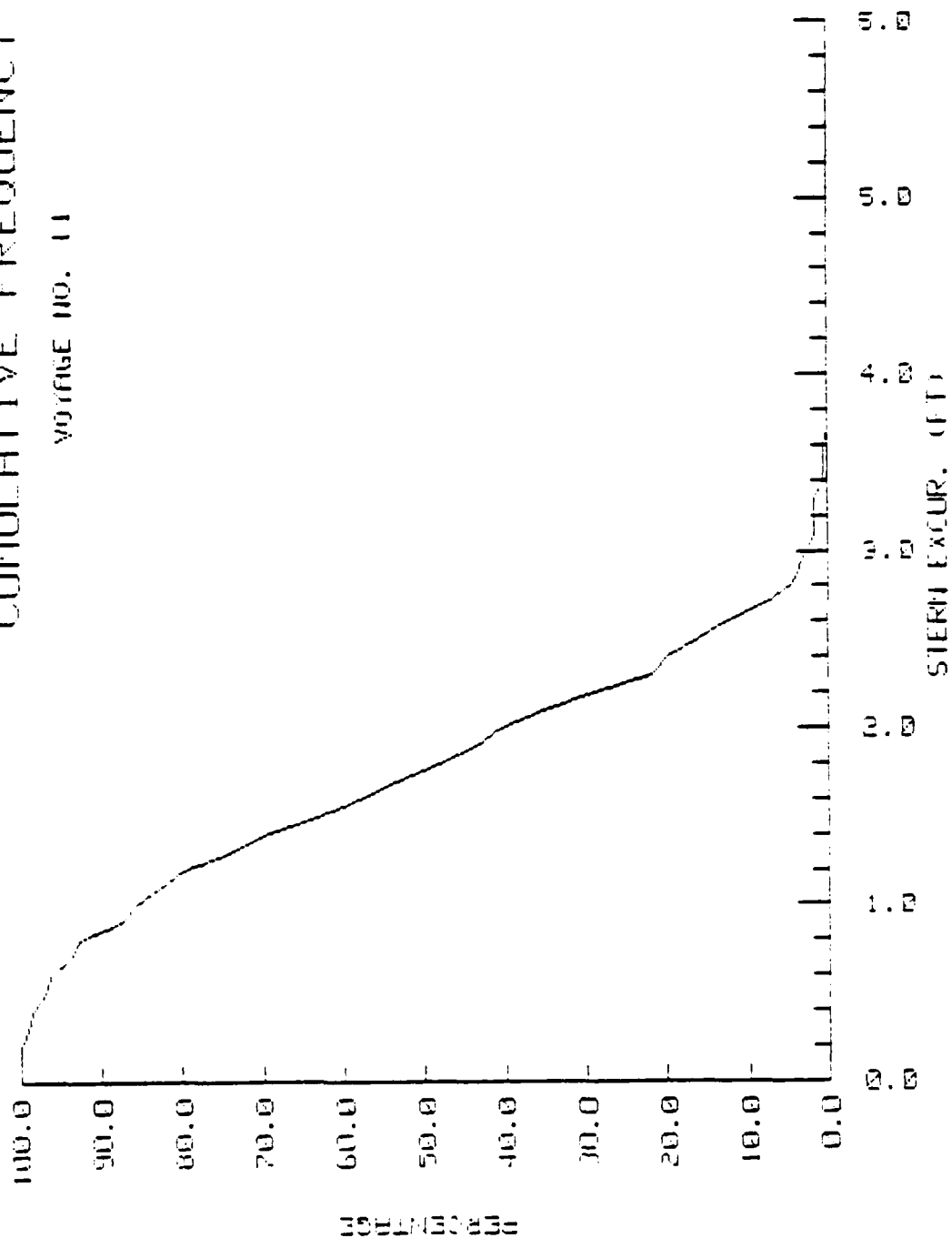
VOLAGE NO. 11





# CUMULATIVE FREQUENCY

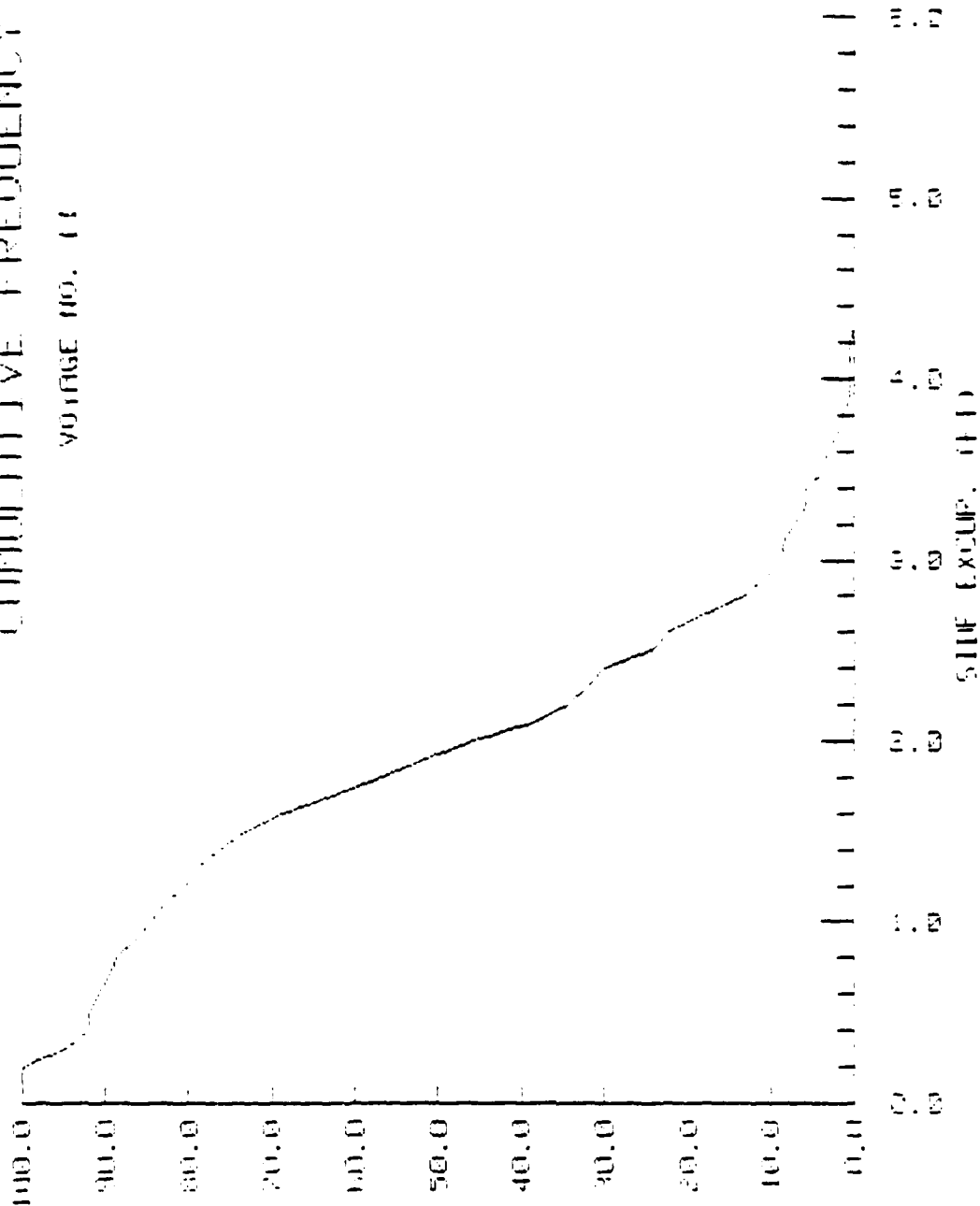
VOLTAGE NO. 11





# CUMULATIVE FREQUENCY

VOLUME NO. 11

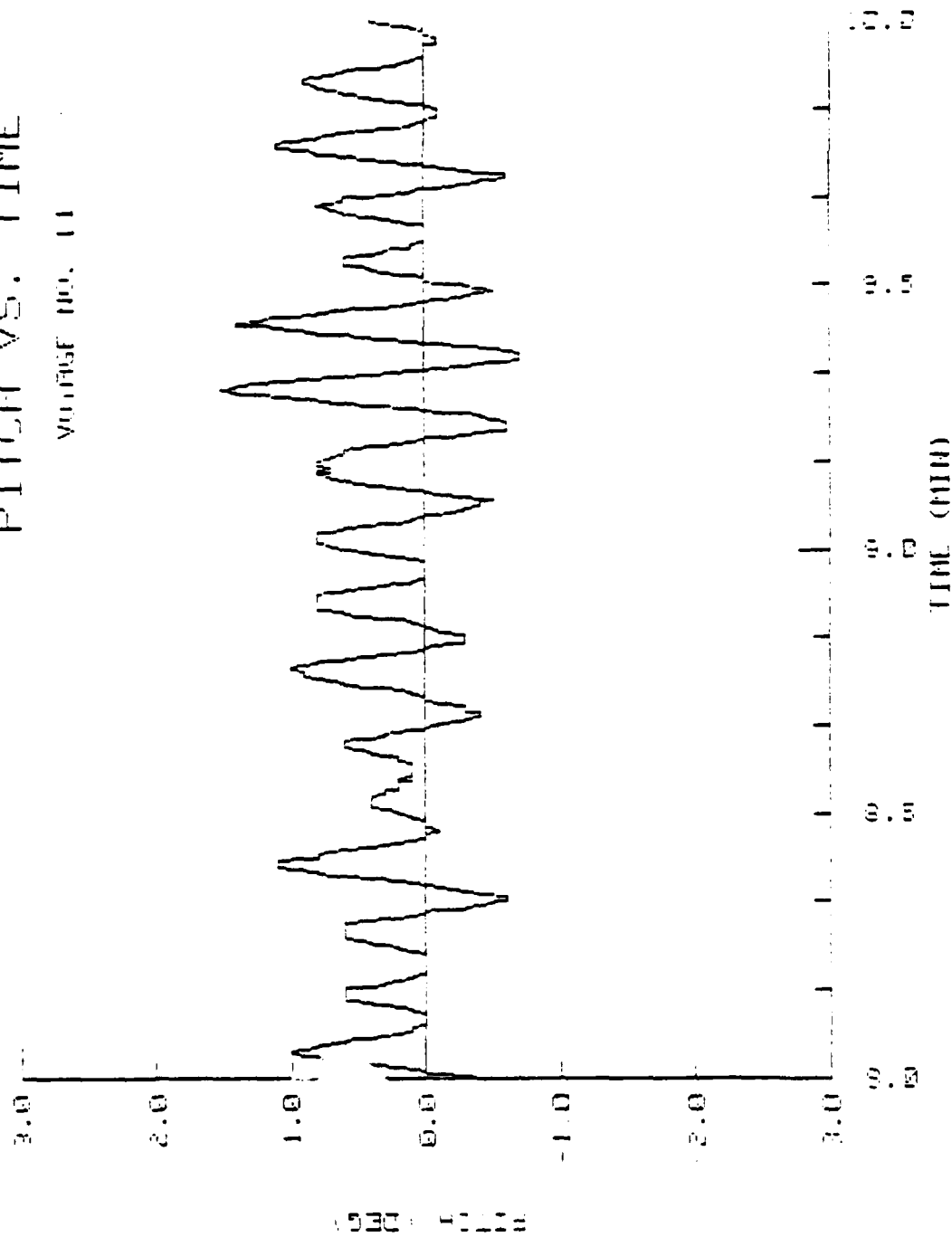


PERCENTAGE



# PITCH VS. TIME

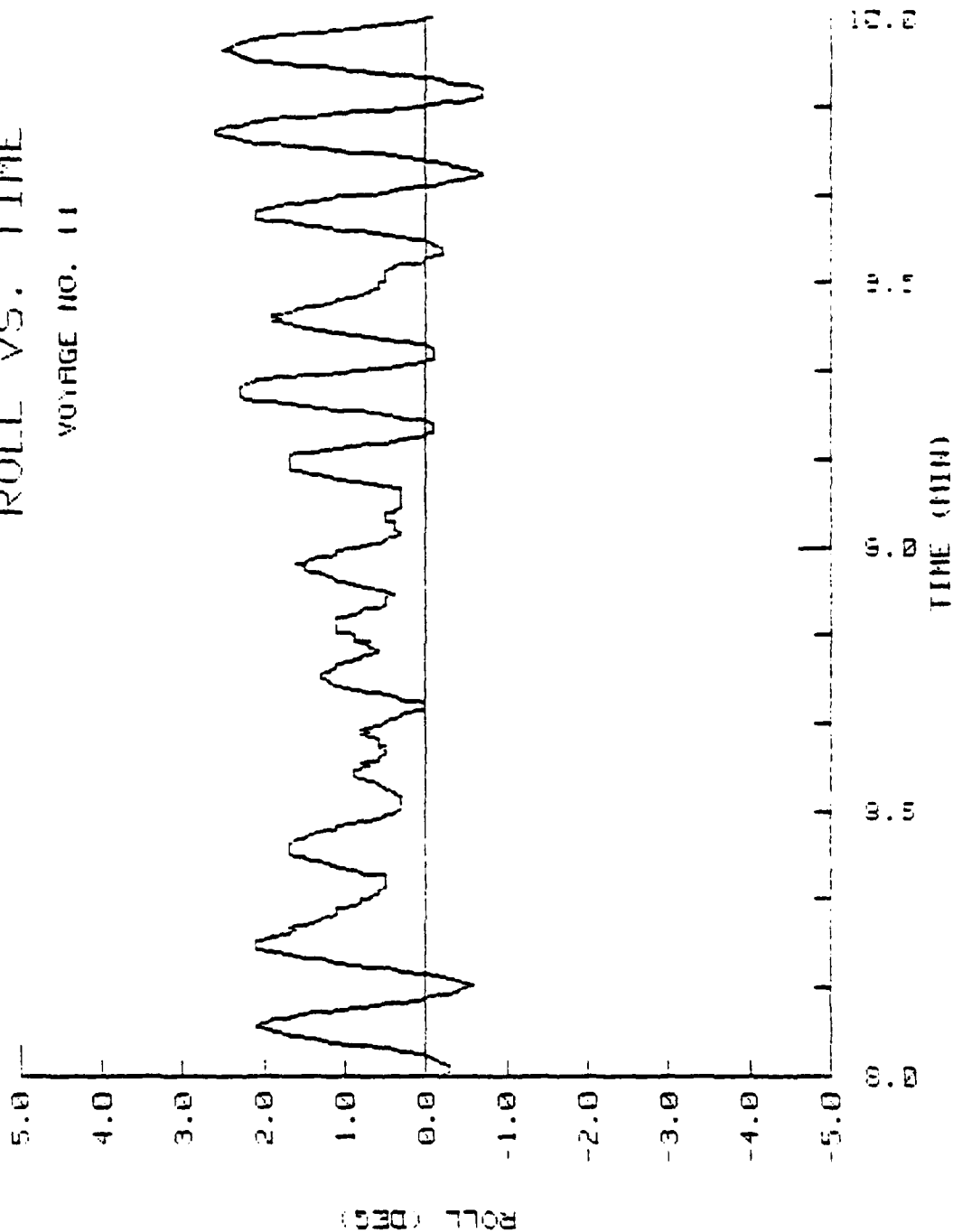
VOLUME NO. 11





# ROLL VS. TIME

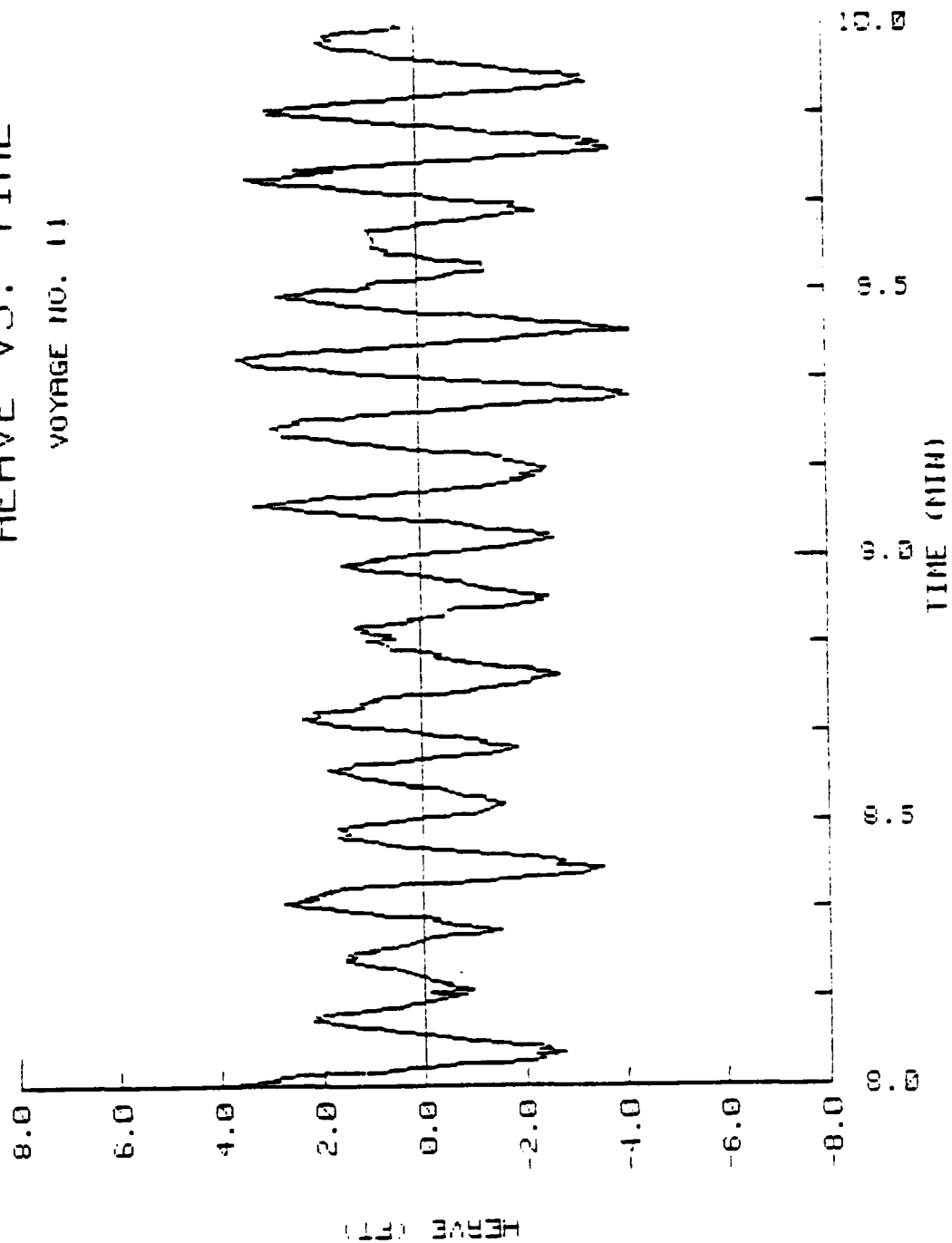
VOLUME NO. 11





# HEAVE VS. TIME

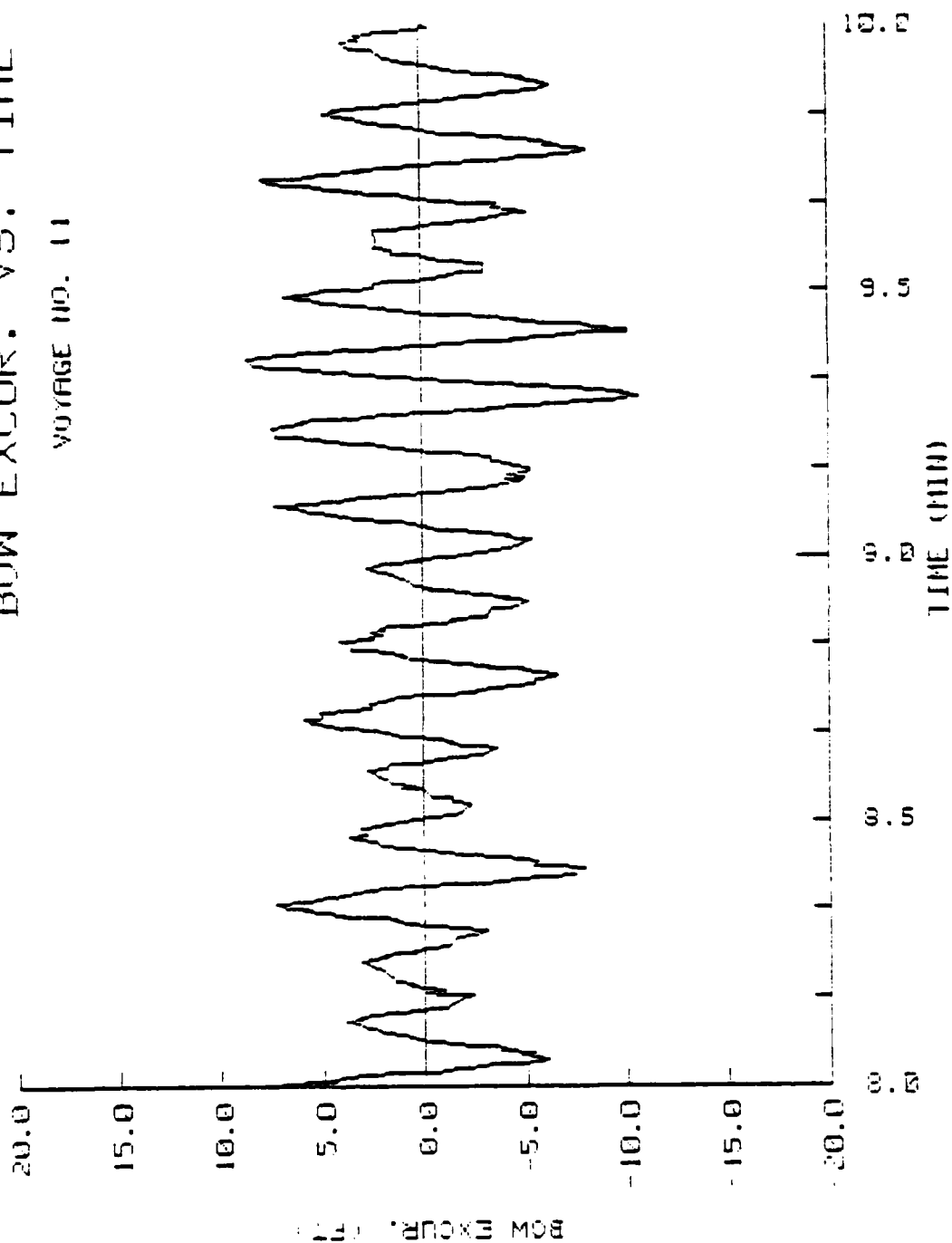
VOYAGE NO. 11





# BOW EXCUR. VS. TIME

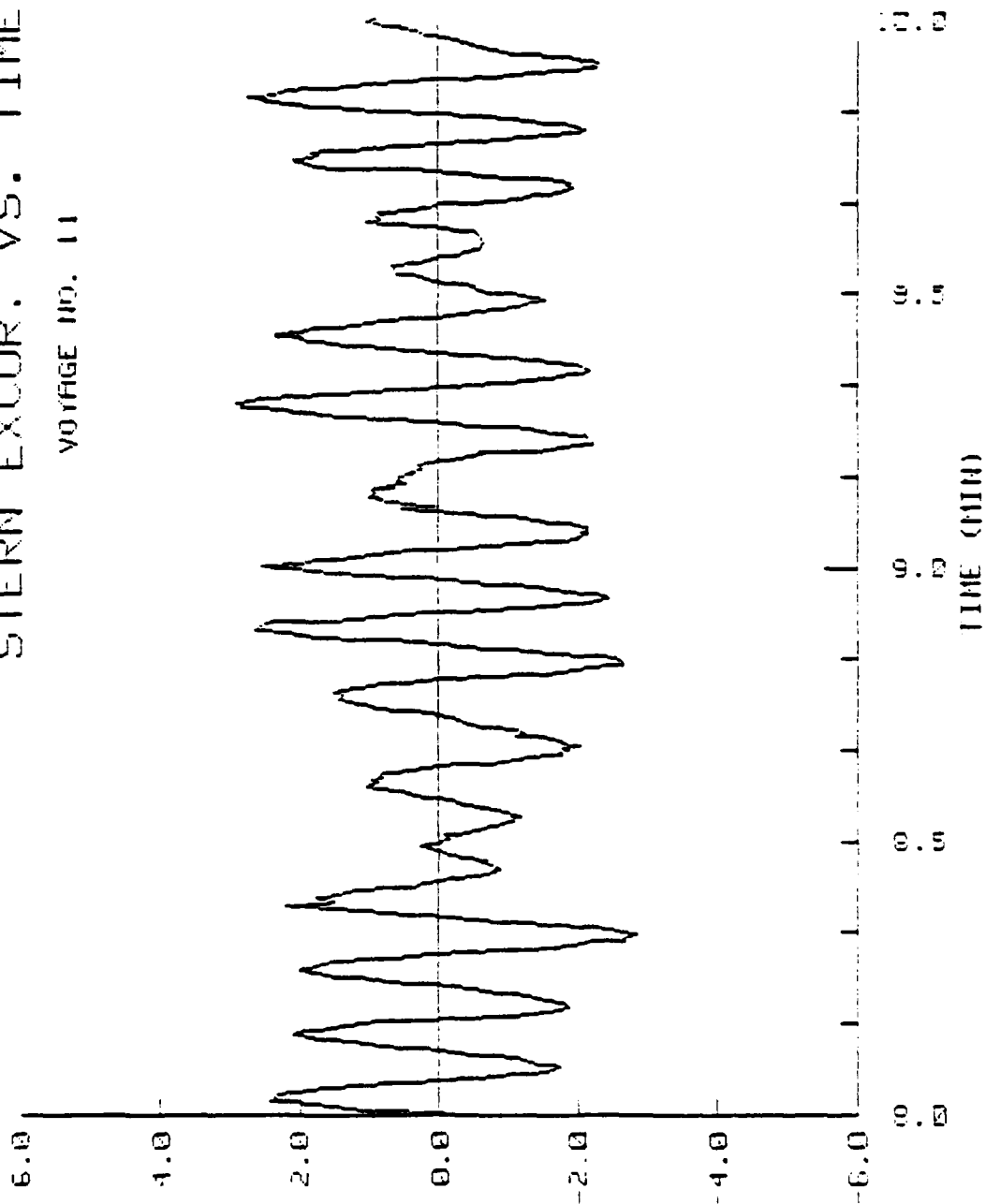
VOYAGE NO. 11





# STERN EXCUR. VS. TIME

VOLTAGE NO. 11

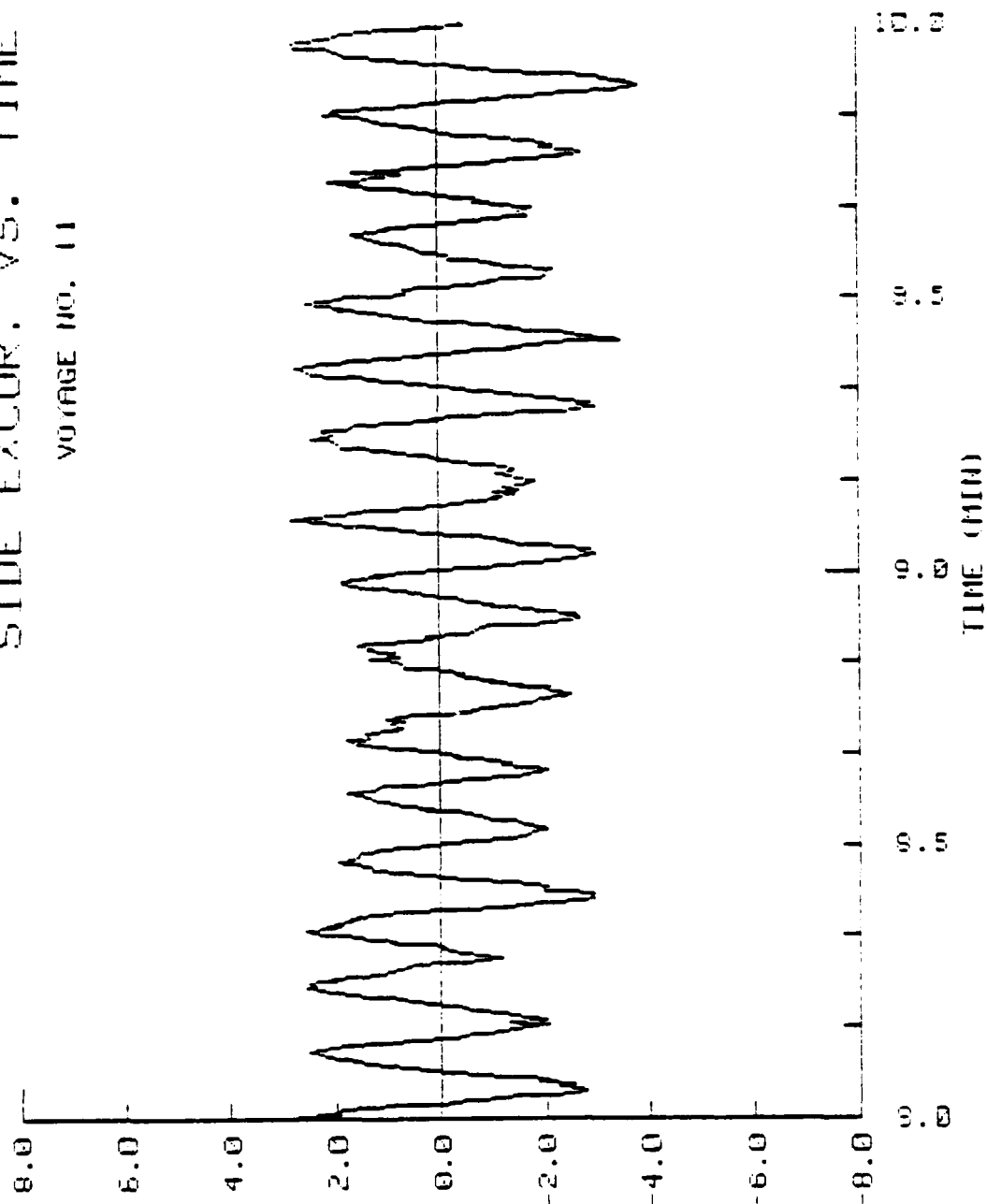


(11) 000000000000



# SIDE EXCUR. VS. TIME

VOLAGE NO. 11



SIDE EXCUR. VS. TIME



# STATISTICAL SUMMARY

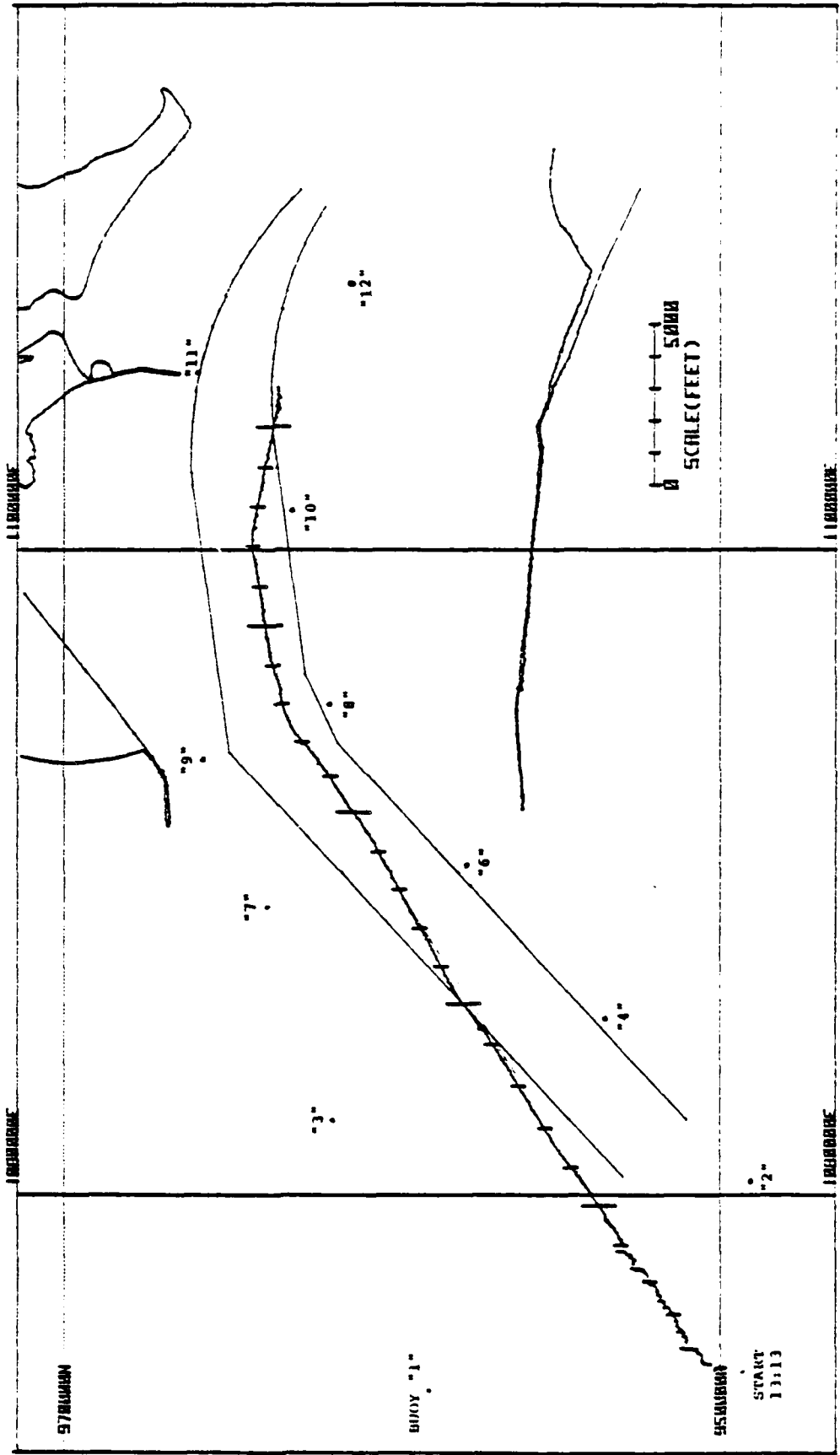
VOYAGE NO. 12

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.8	.8	.4	.4
ROLL (DEG)	.6	3.4	1.3	1.6
YAW (FT/SEC/SEC)	-.0	2.5	.8	.9
HEAVE (FT)	.0	1.8	.8	.8
BOOM EXCUR. (FT)	.0	6.3	2.4	2.8
STERN EXCUR. (FT)	.0	3.4	1.3	1.5
SIDE EXCUR. (FT)	.0	3.5	1.2	1.5



# VOYAGE NO. 12 SHIP TRACK

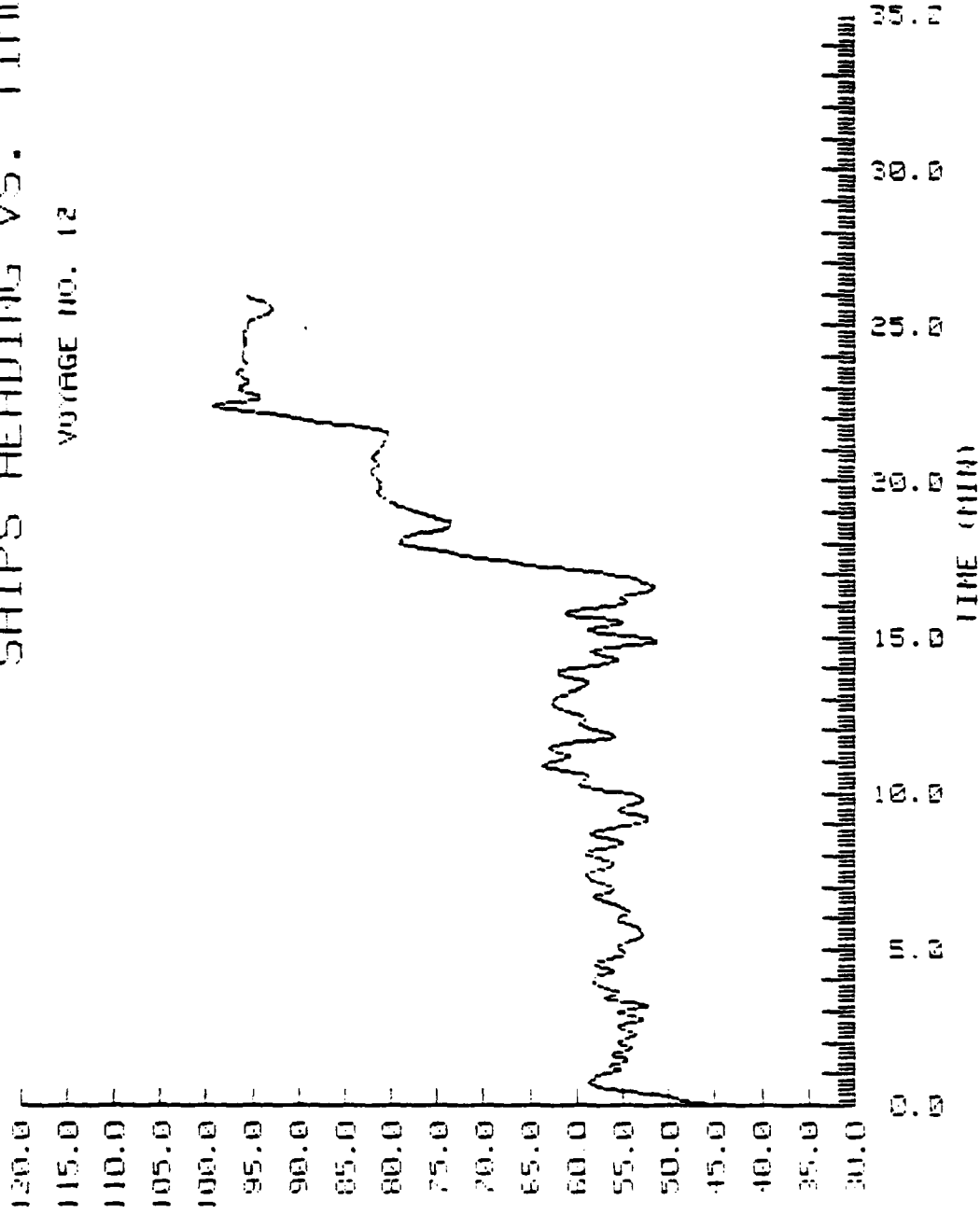
SCALE 1: 30000





# SHIPS HEADING VS. TIME

VOYAGE NO. 12

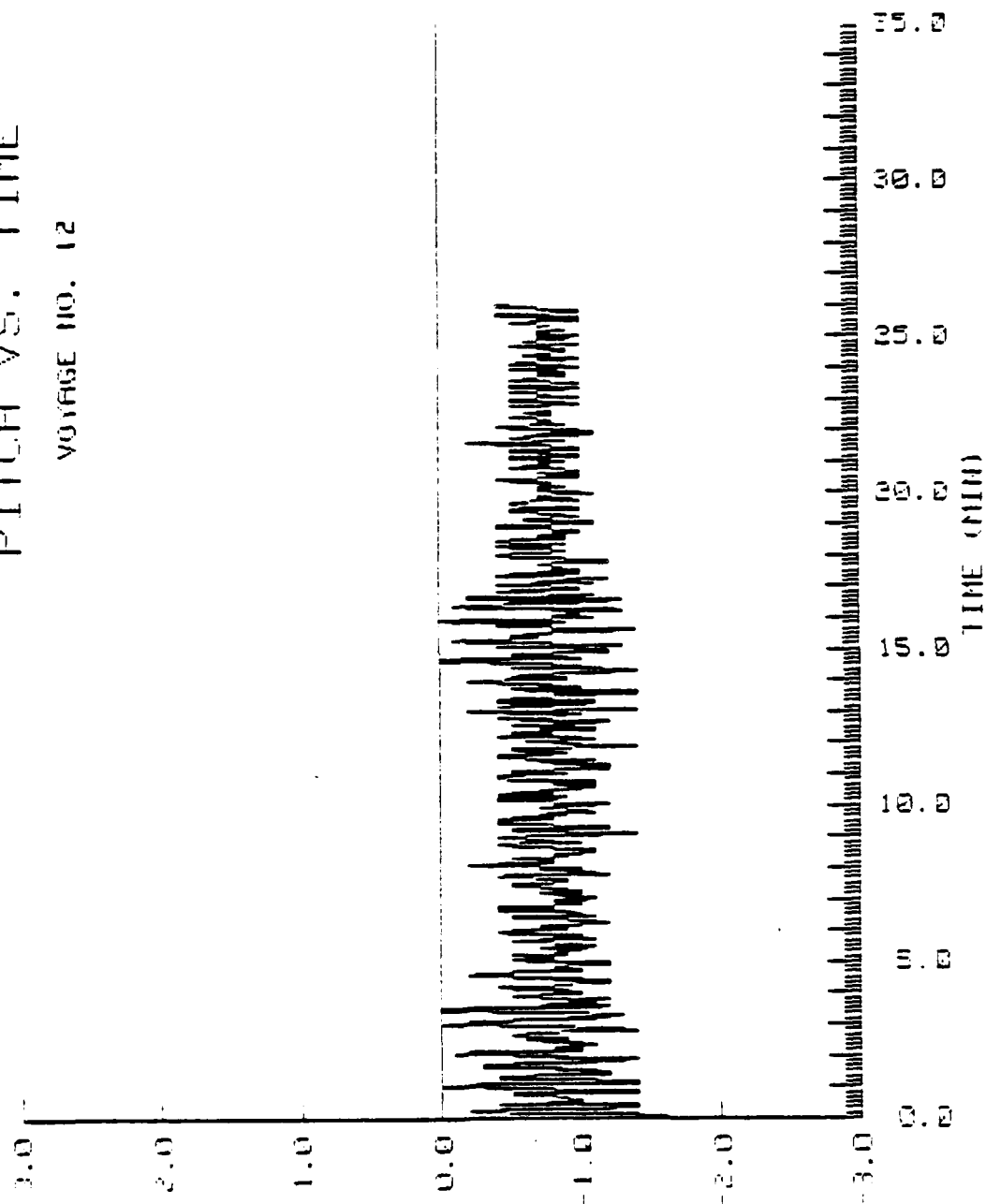


120.0 115.0 110.0 105.0 100.0 95.0 90.0 85.0 80.0 75.0 70.0 65.0 60.0 55.0 50.0 45.0 40.0 35.0 30.0



# PITCH VS. TIME

VORAGE NO. 12

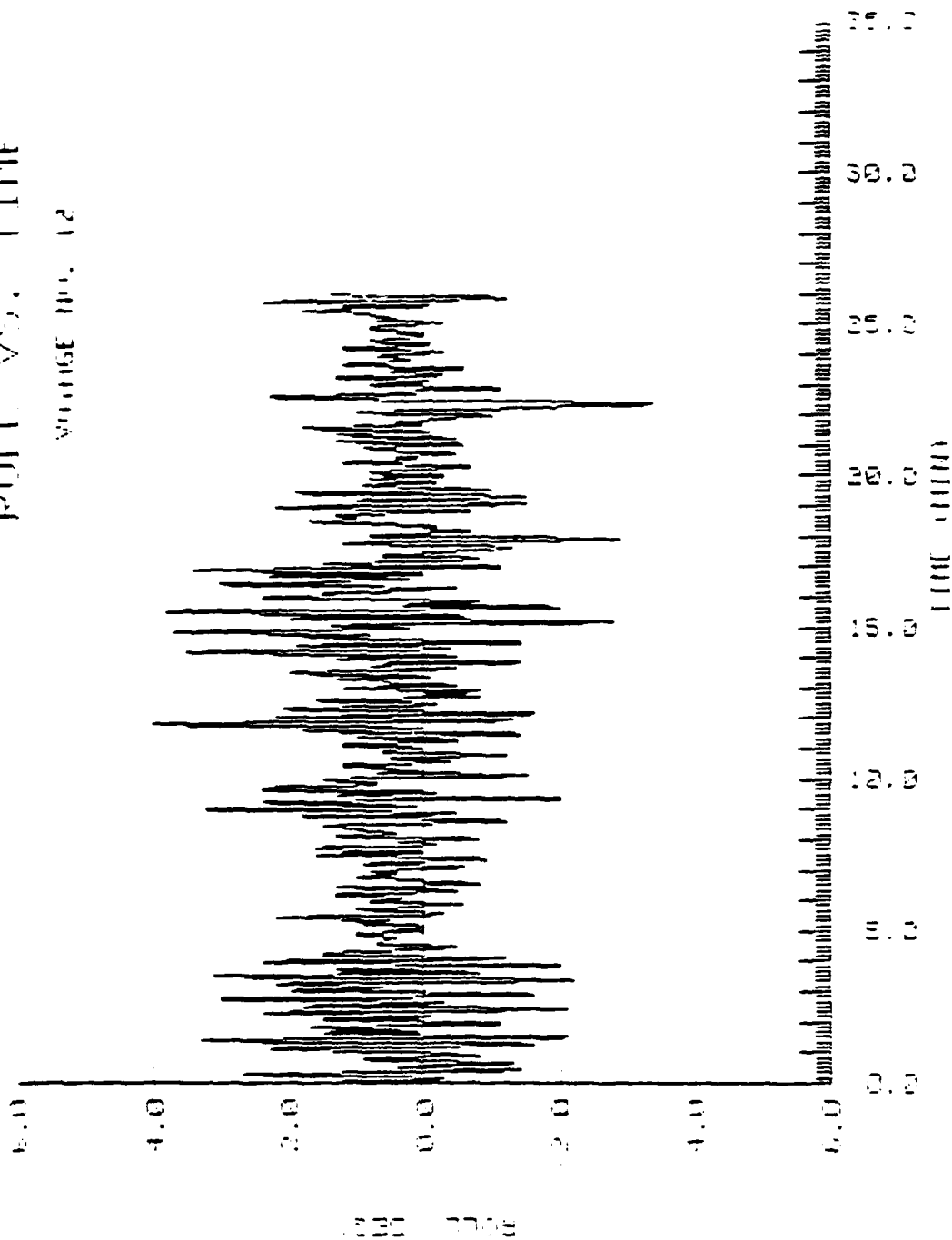


1000 - 10000



# POLL V% TIME

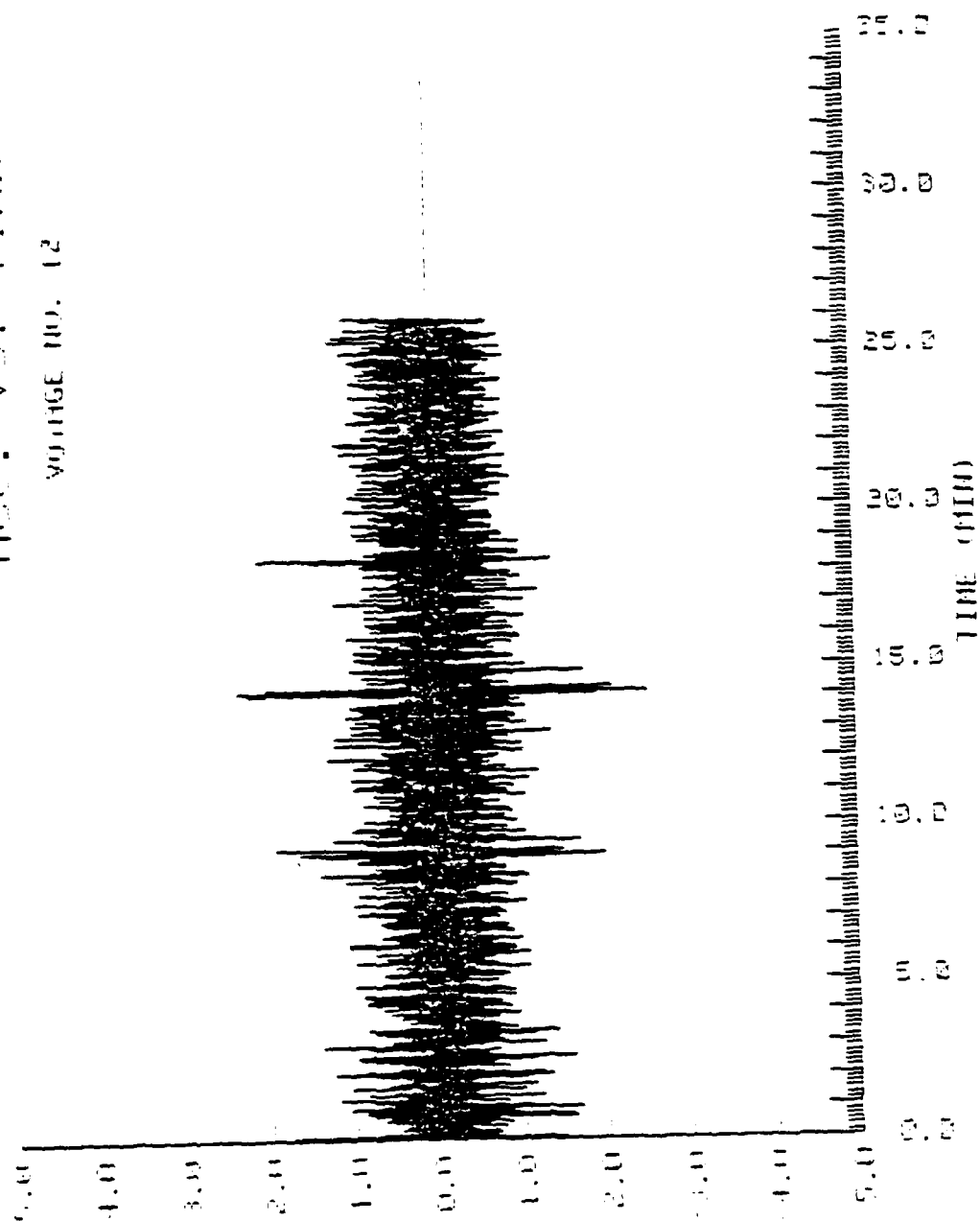
VOLUME 100, 12





NO. VS. TIME

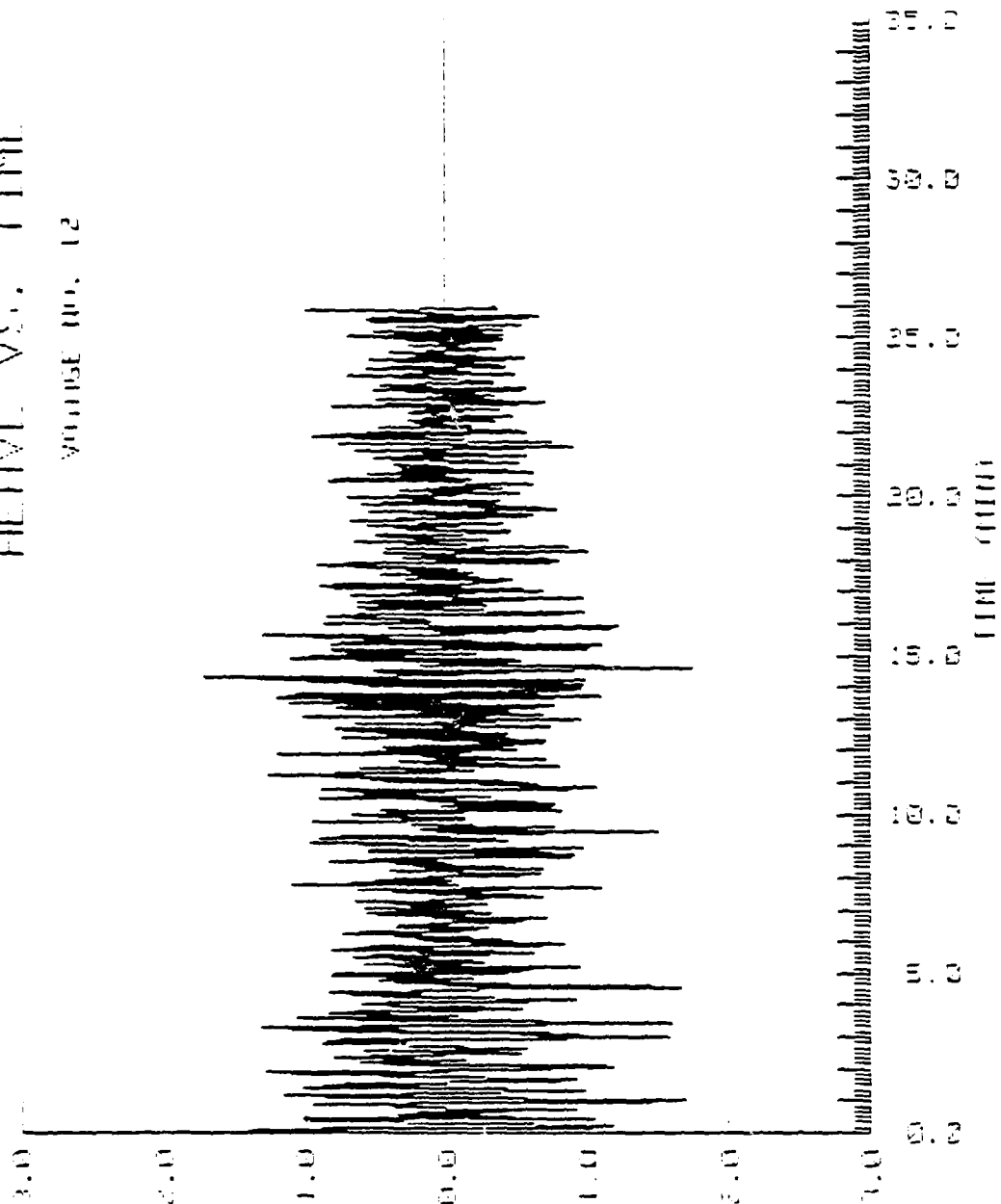
VOLUME NO. 12





# HEAVE VEG. TIME

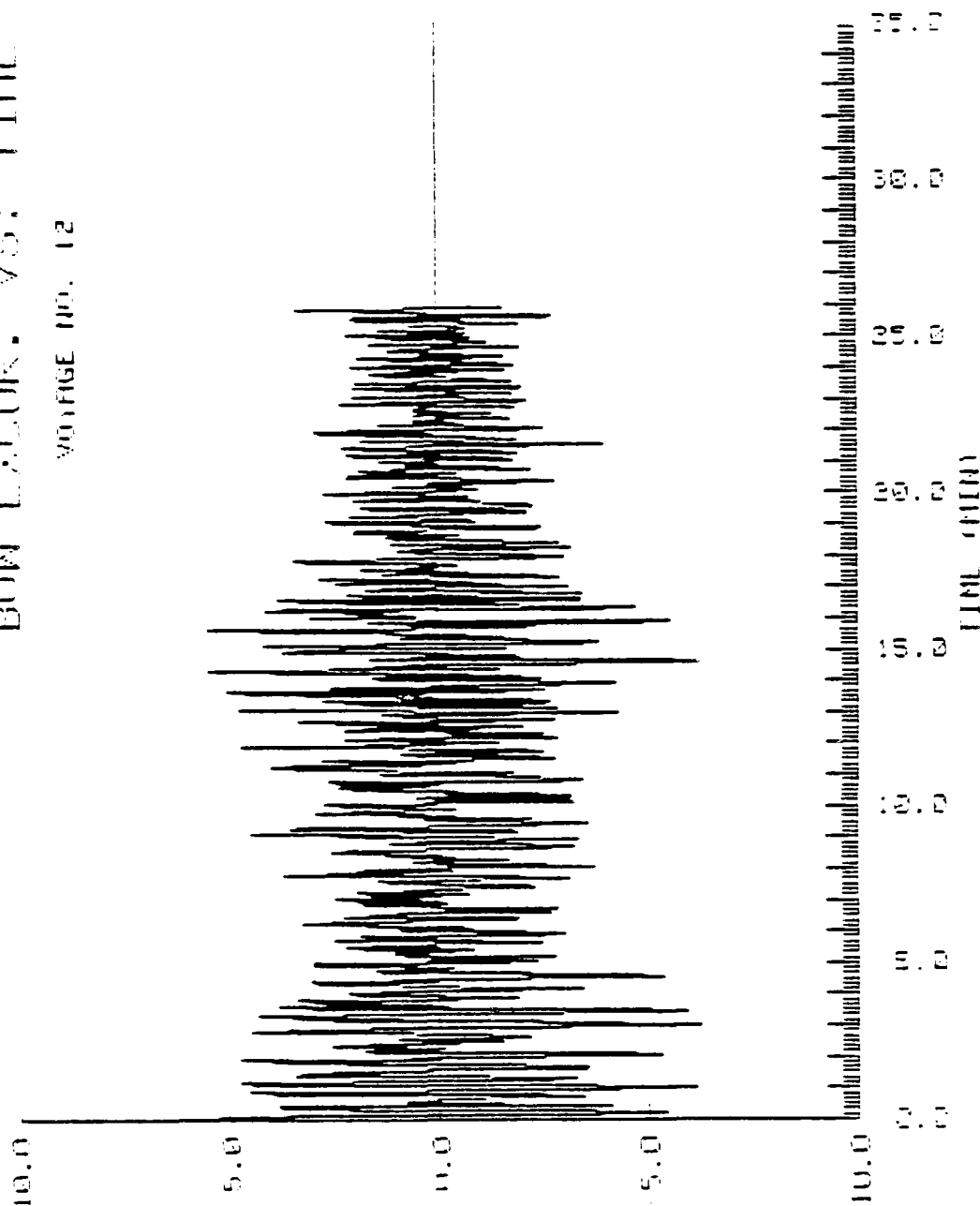
VOYAGE NO. 12





BOW EXCUR. V5: TIML

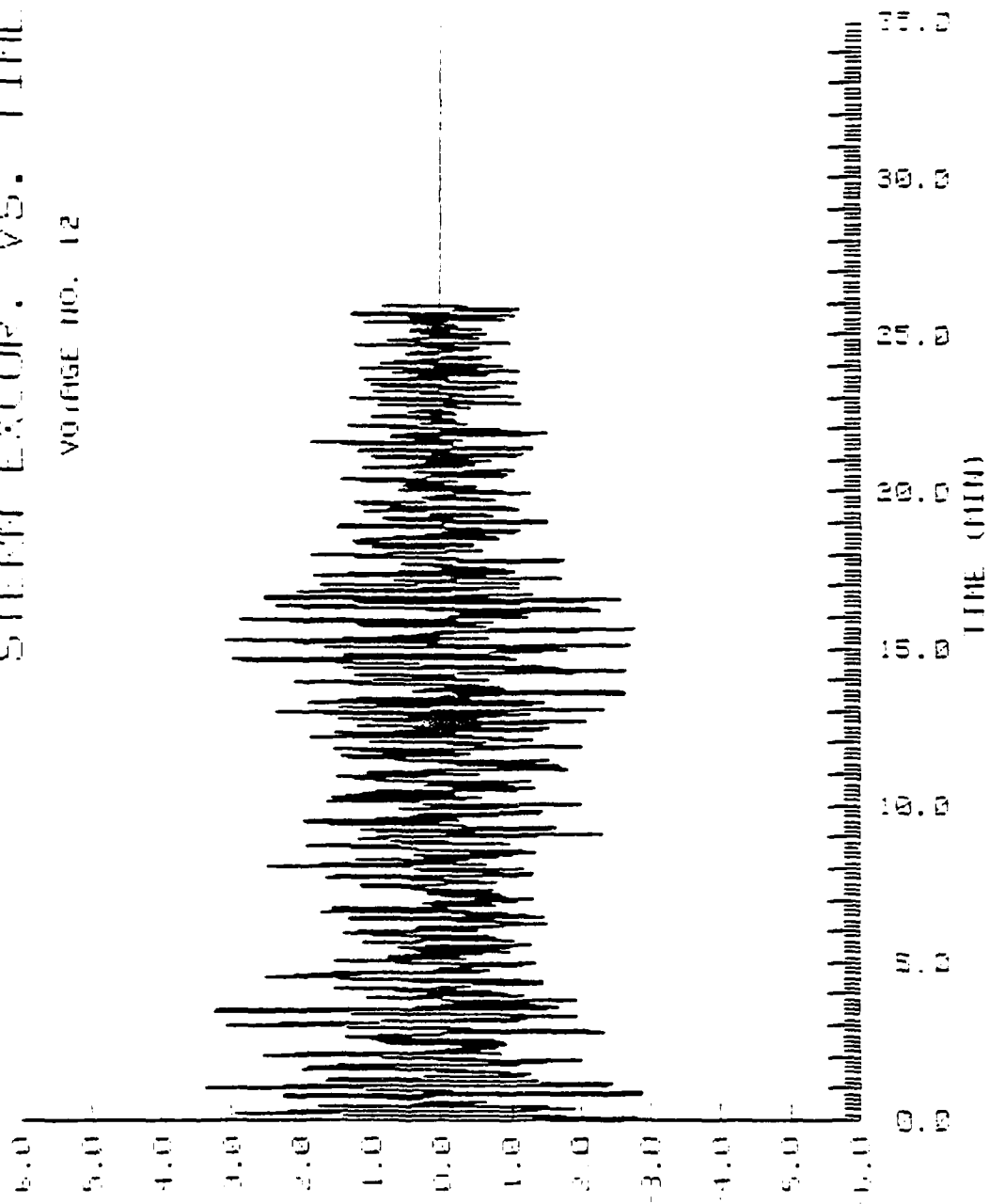
VOL. FIGE NO. 12





STEM EXCUR. VS. TIME

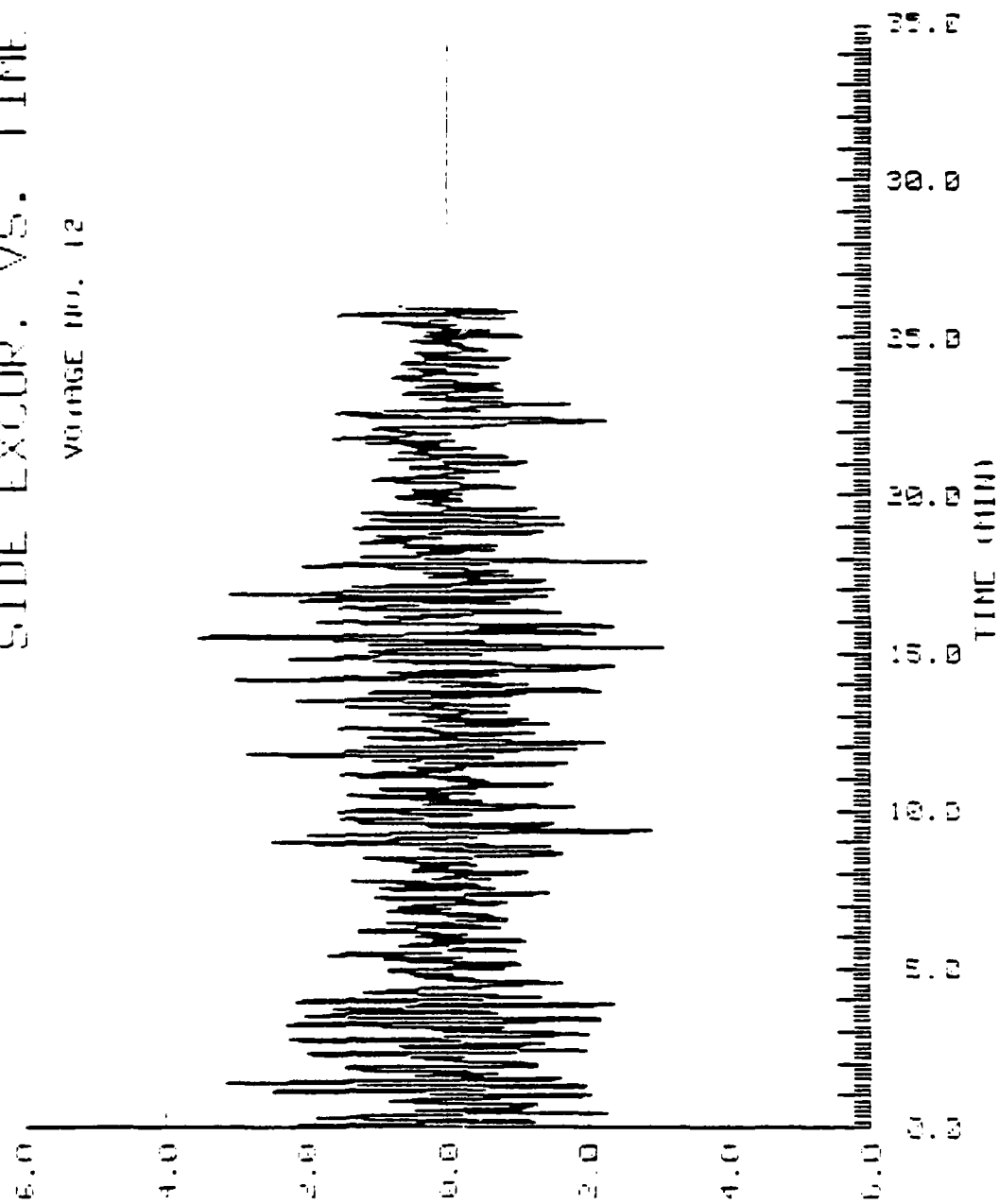
VOIAGE NO. 12



1.0 2.0 3.0 4.0 5.0 6.0



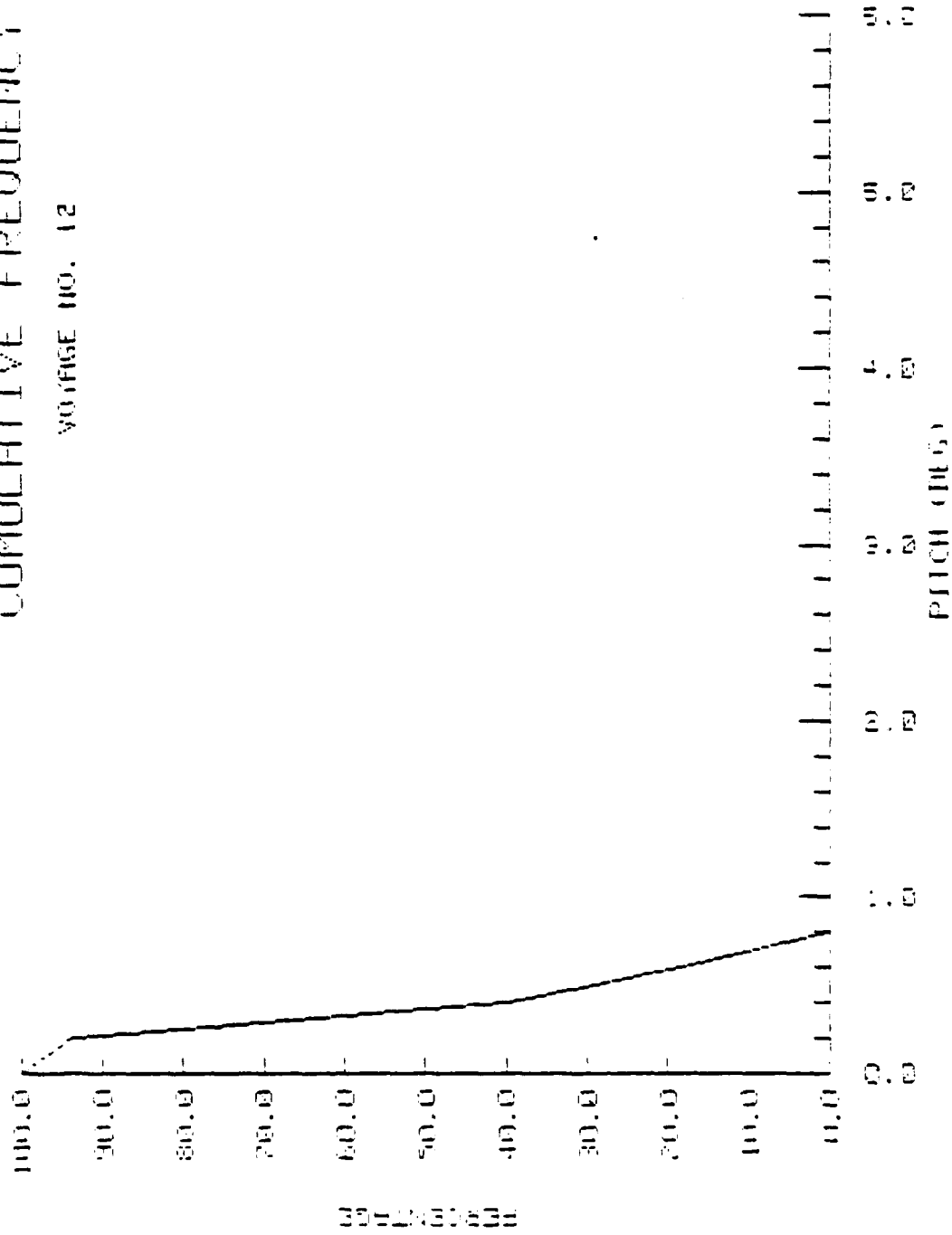
## VOLUME IV. 12





# CUMULATIVE FREQUENCY

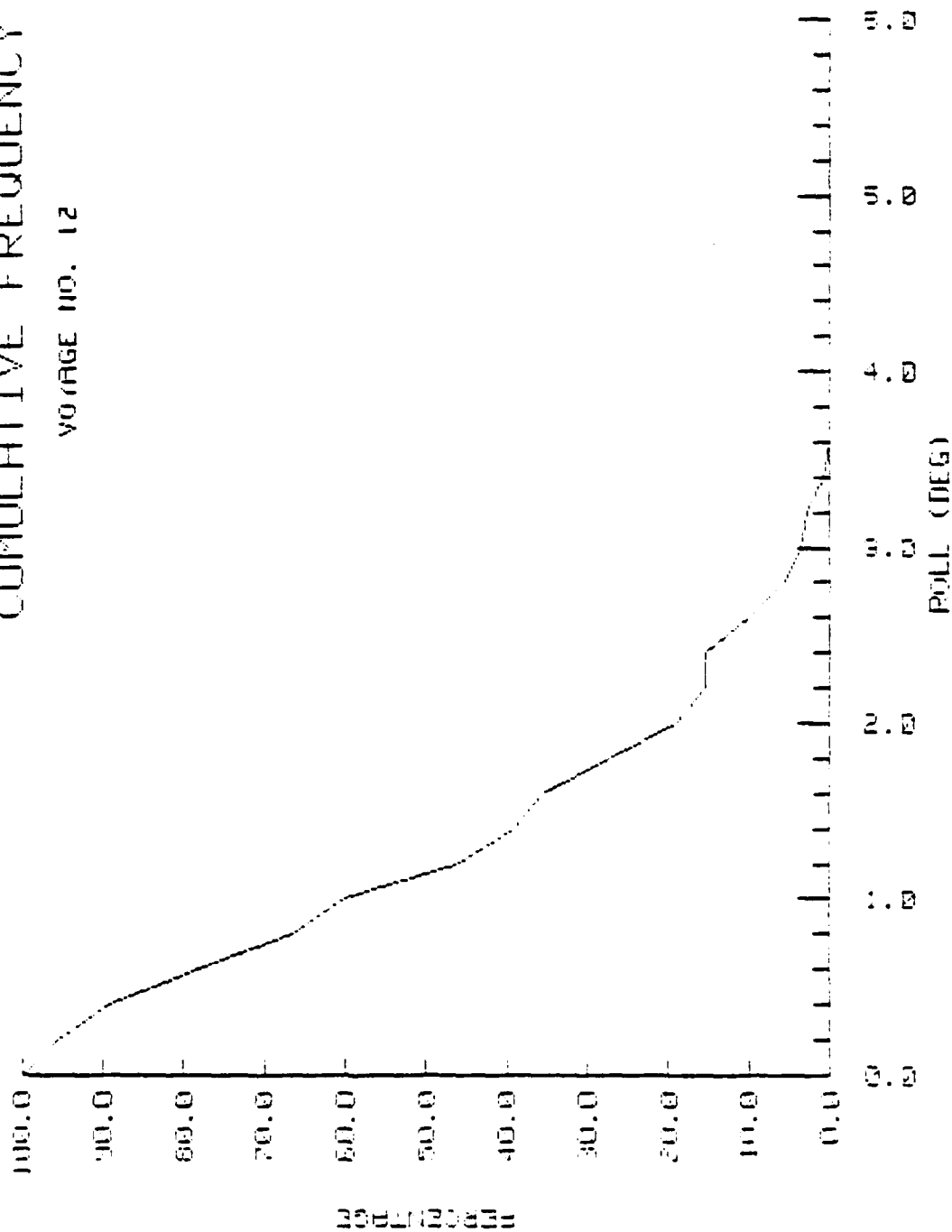
VOLAGE NO. 12





# CUMULATIVE FREQUENCY

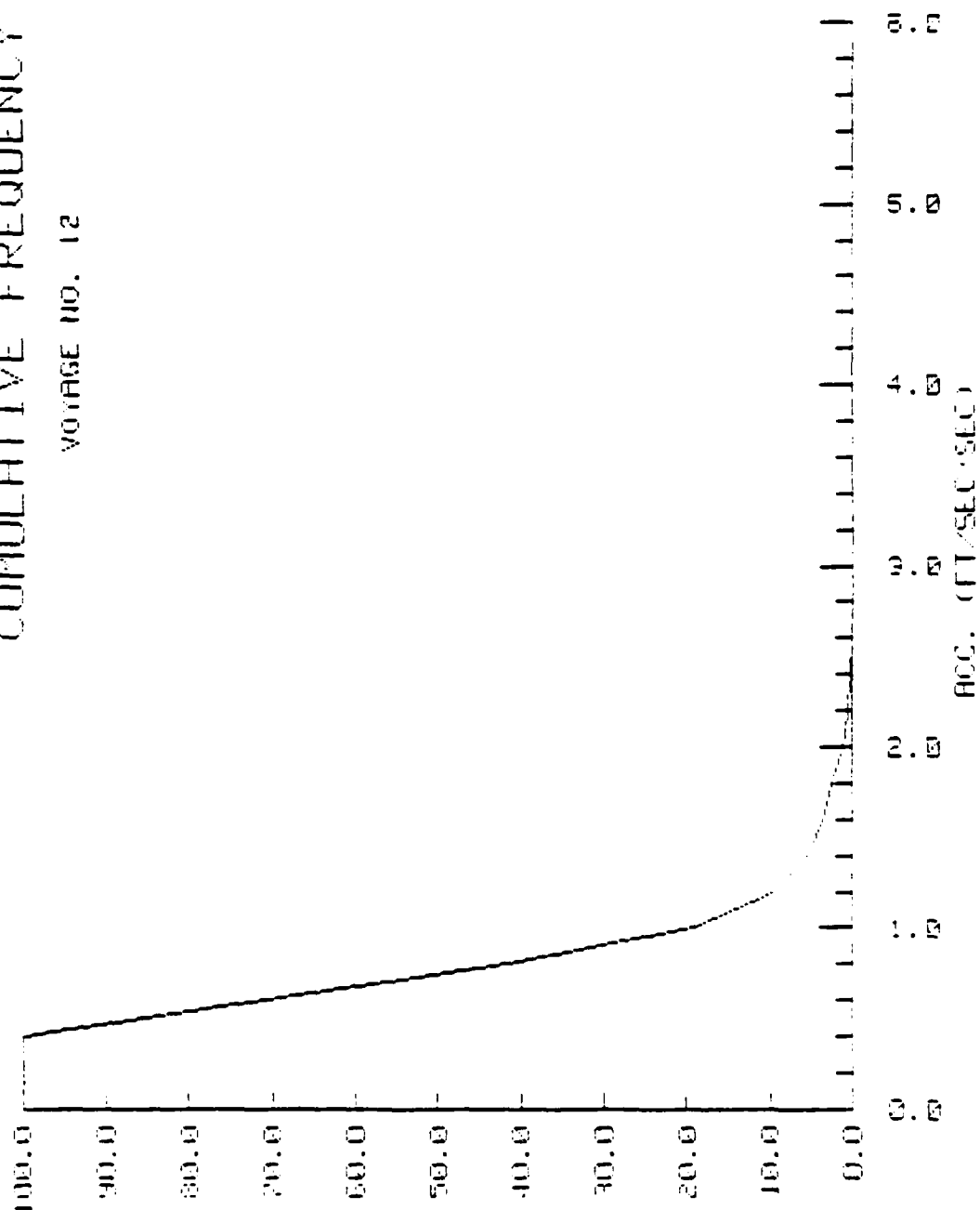
VORAGE NO. 12





# CUMULATIVE FREQUENCY

VOTAGE NO. 12

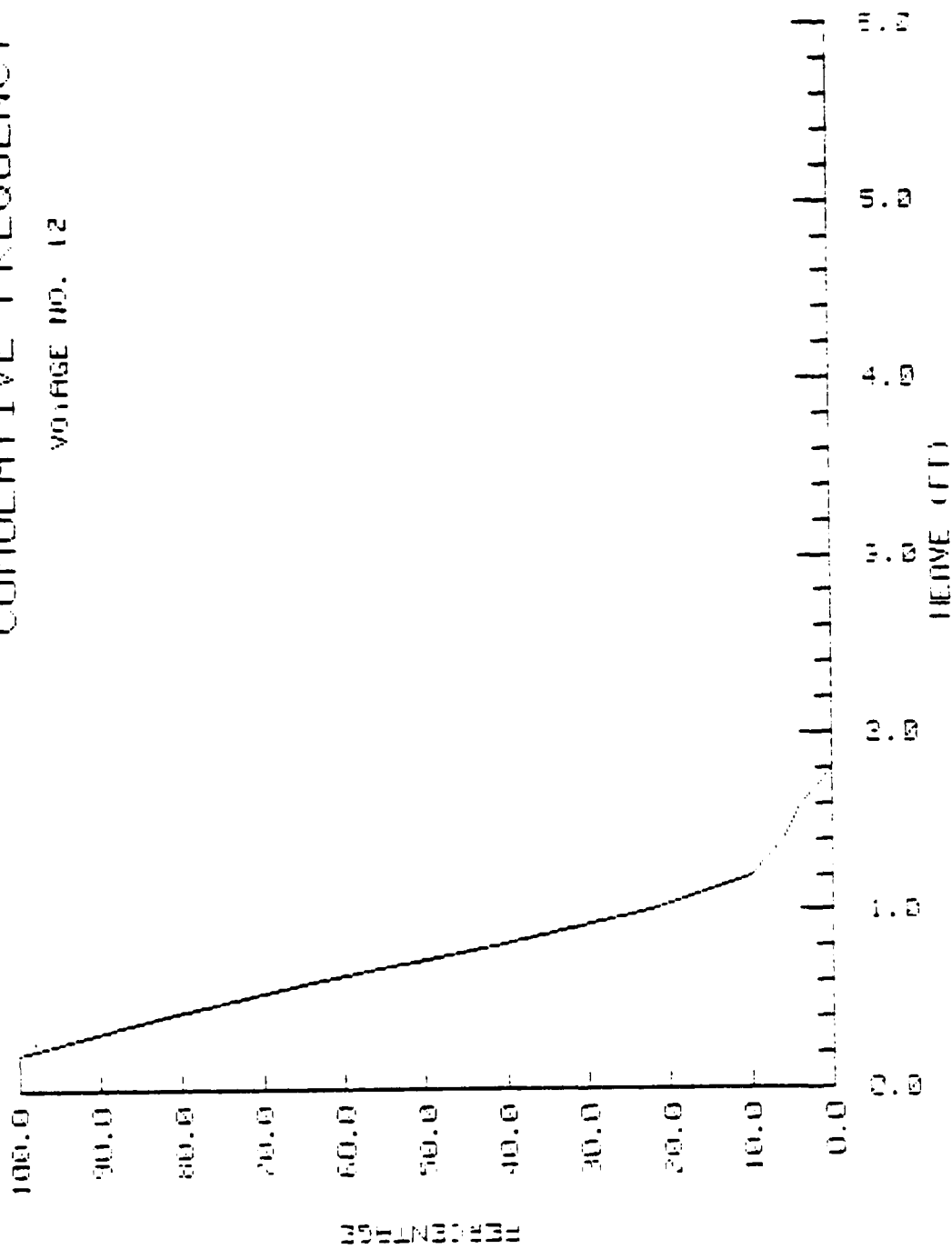


35-17-13-001



# CUMULATIVE FREQUENCY

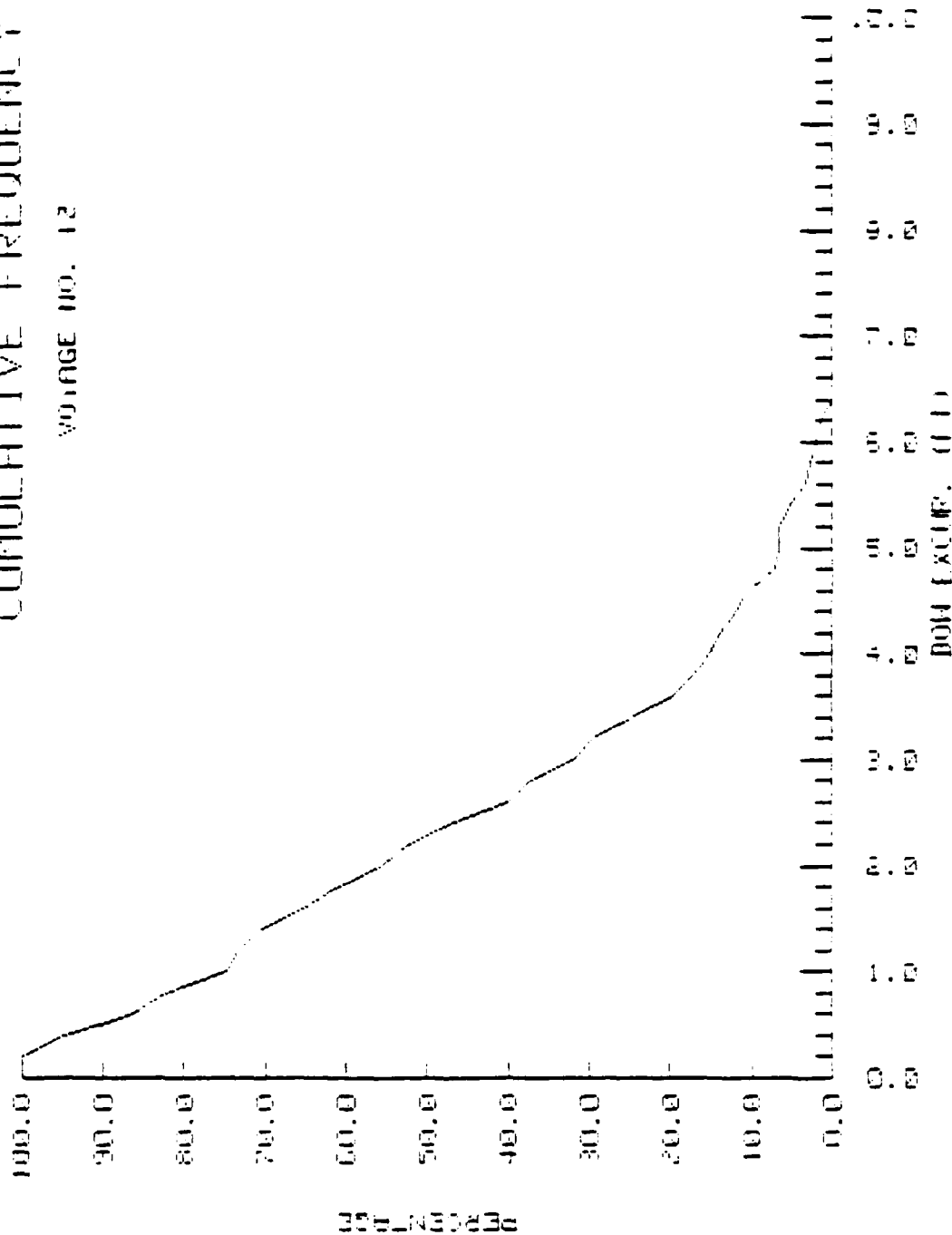
VOLUME NO. 12





# CUMULATIVE FREQUENCY

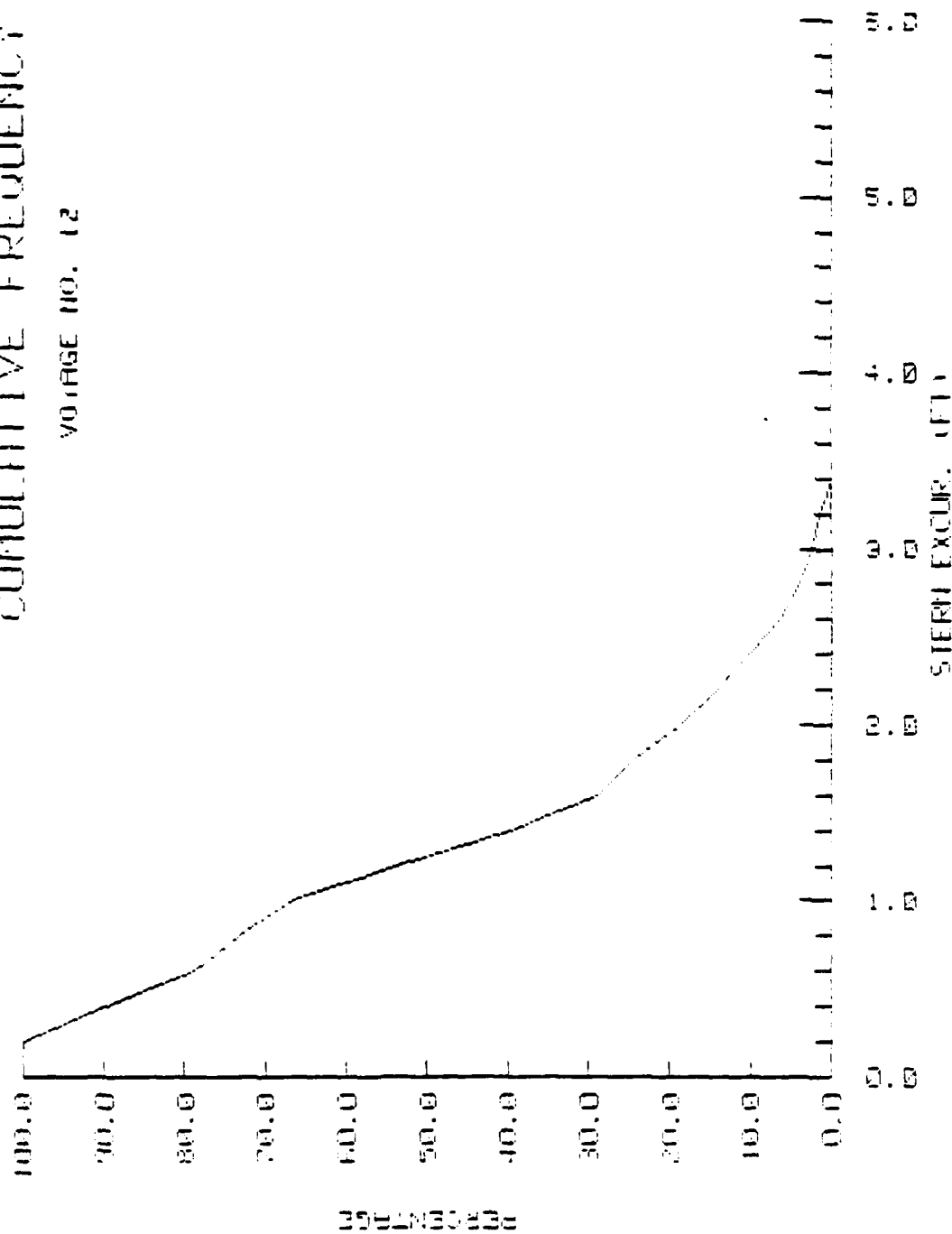
VOLAGE NO. 12





# CUMULATIVE FREQUENCY

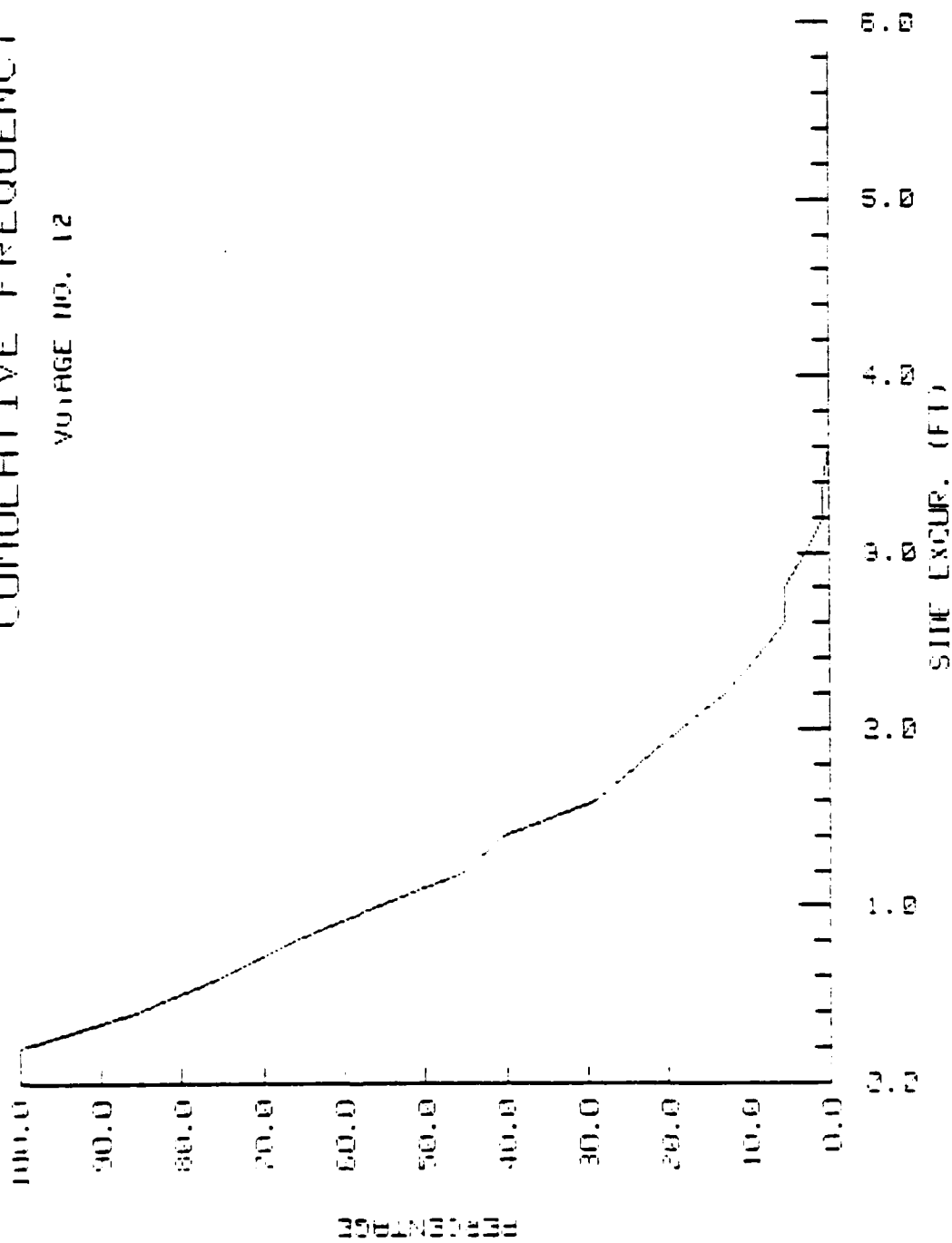
VOLAGE NO. 12





# CUMULATIVE FREQUENCY

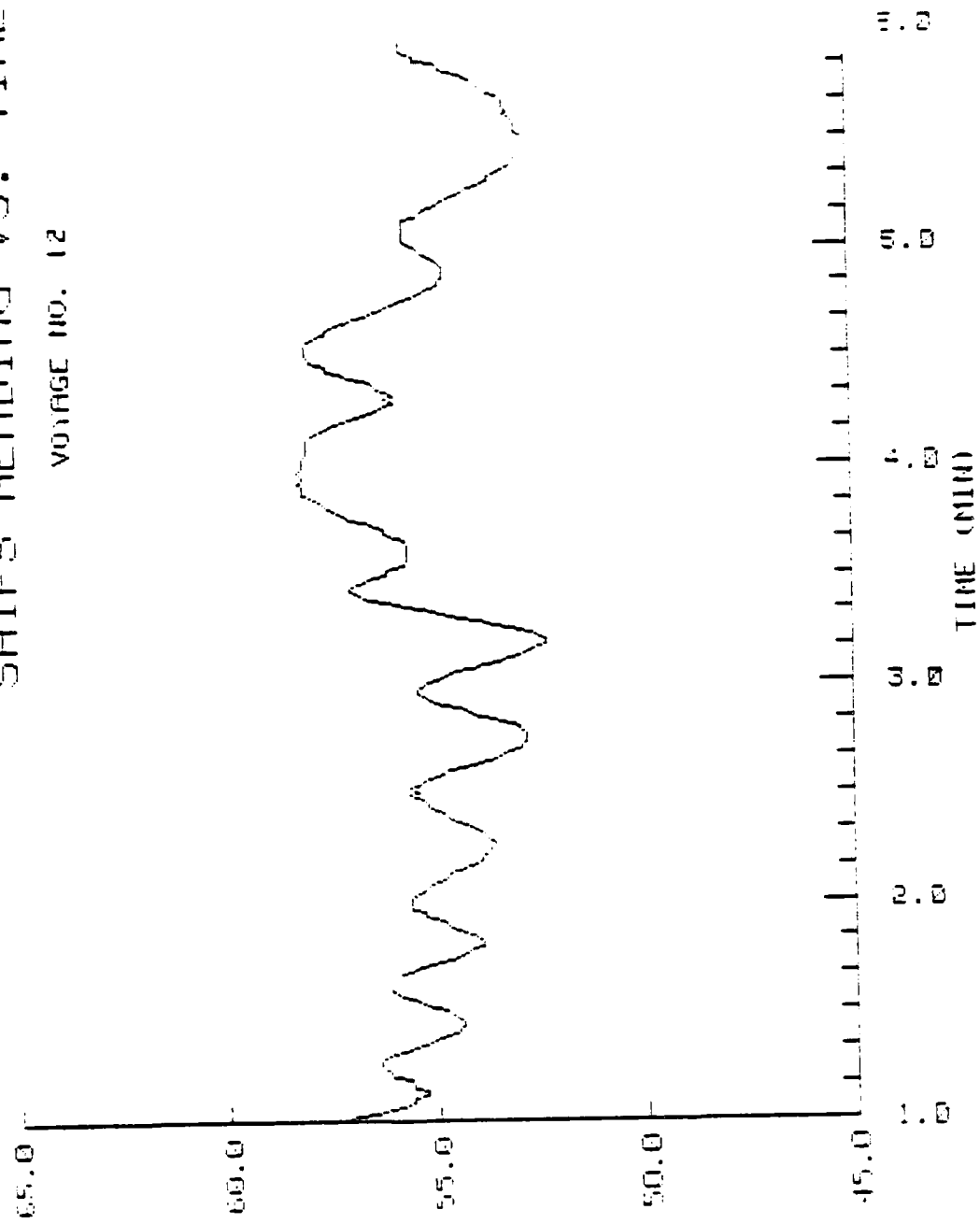
VOLUME NO. 12





# SHIPS HEADING VS. TIME

VOLUME NO. 12

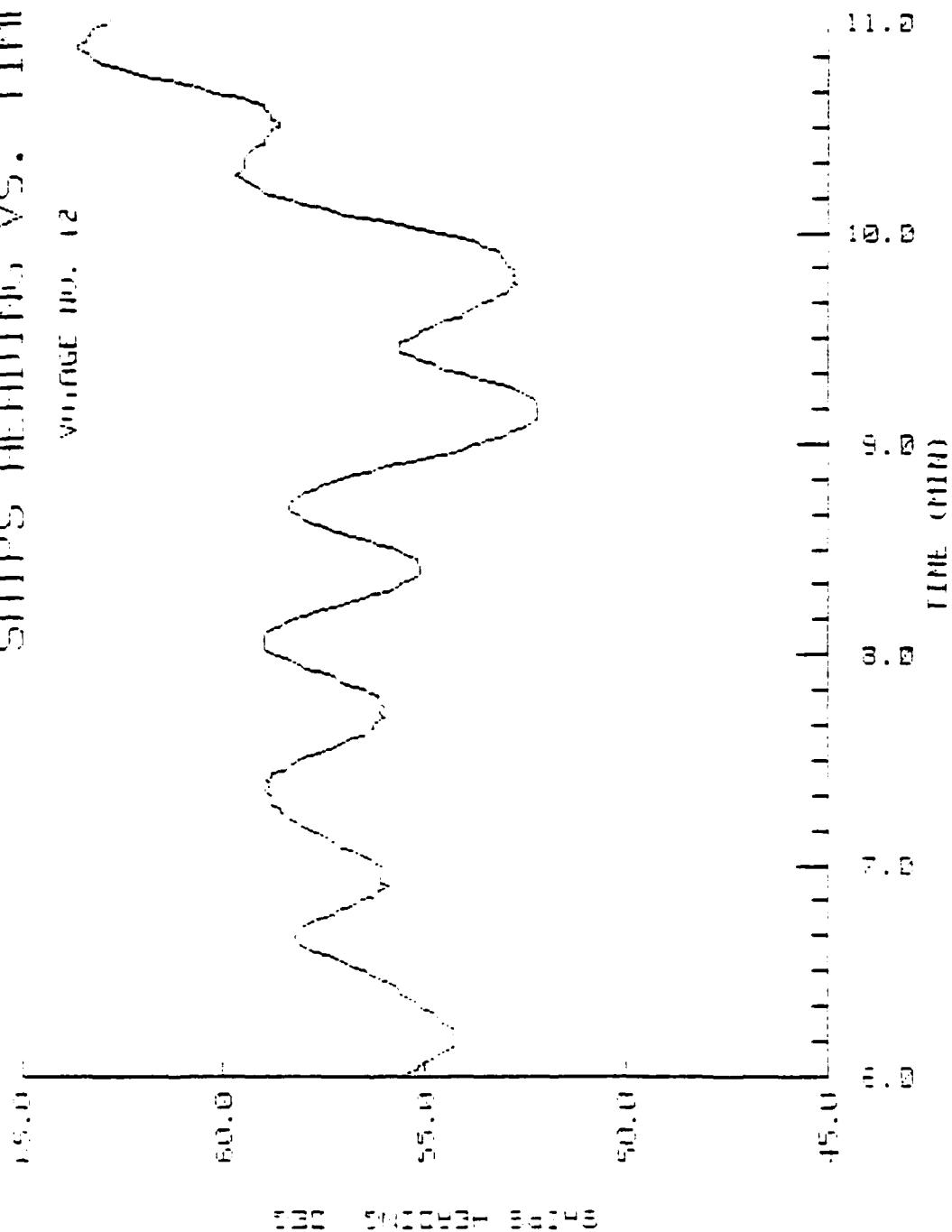


SHIPS HEADING VS. TIME



# SHIPS HEADING VS. TIME

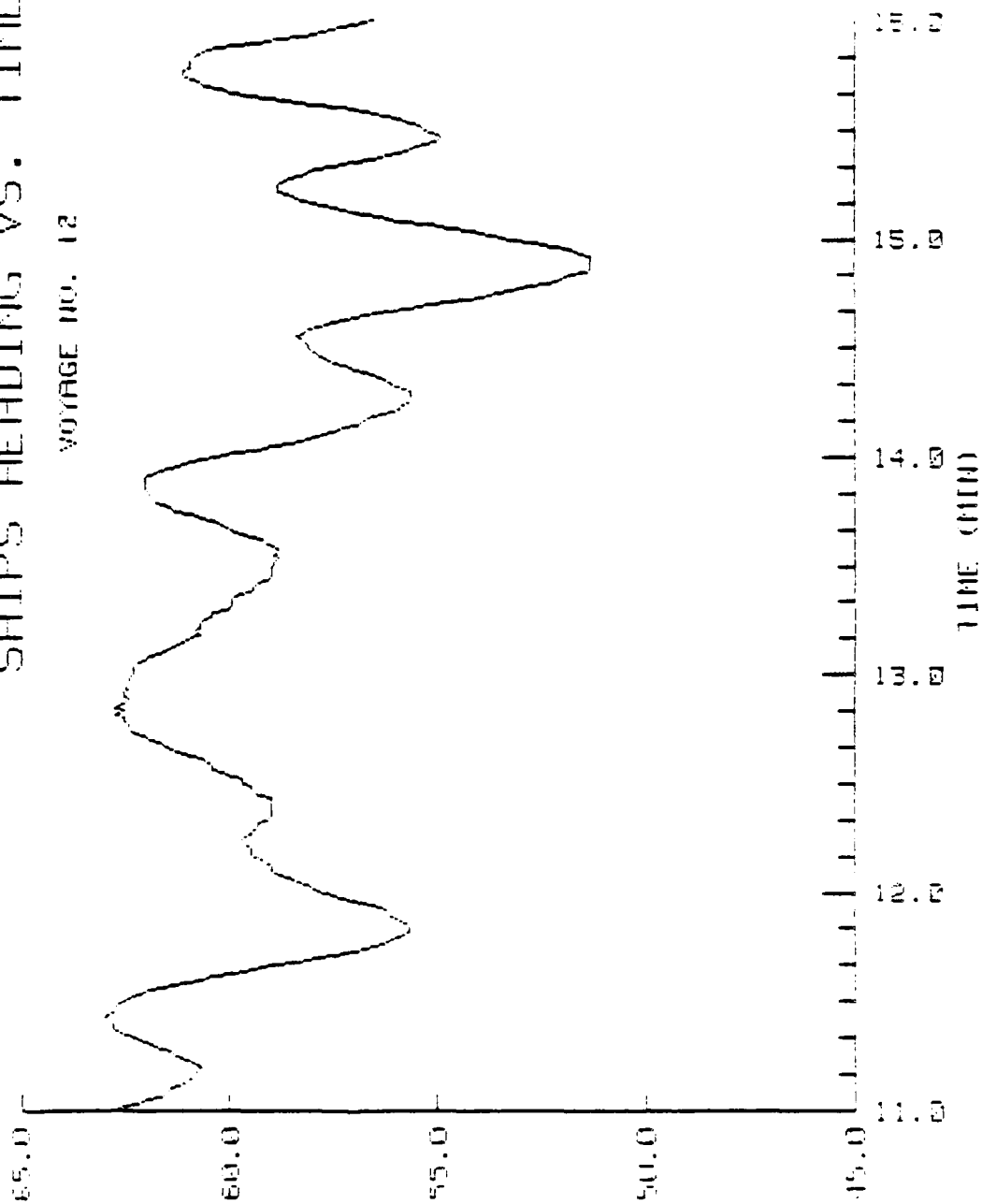
VOLUME NO. 12





# SHIPS HEADING VS. TIME

VOYAGE NO. 12

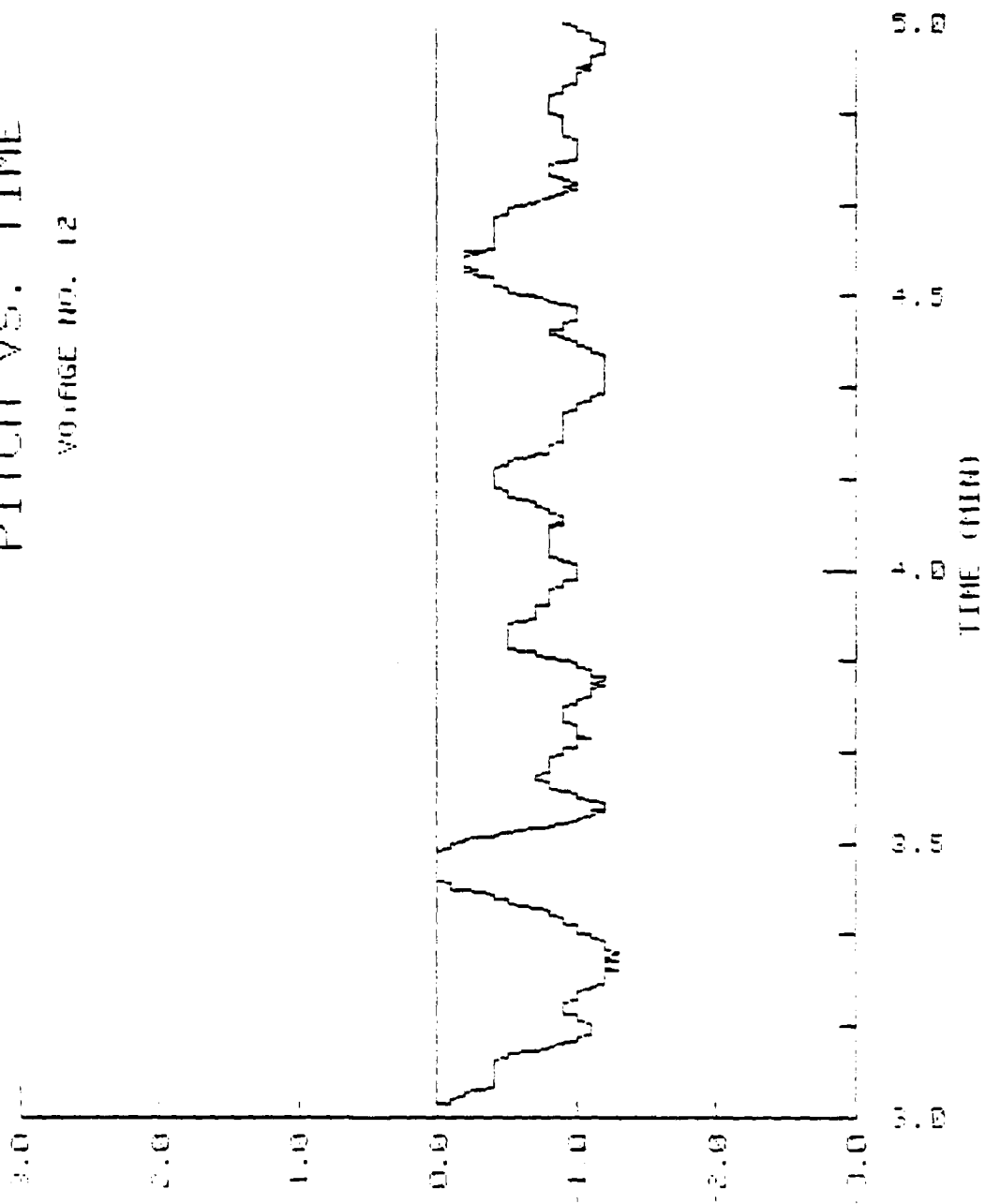


0000 00000000 000000



# PITCH VS. TIME

VOICE NO. 12

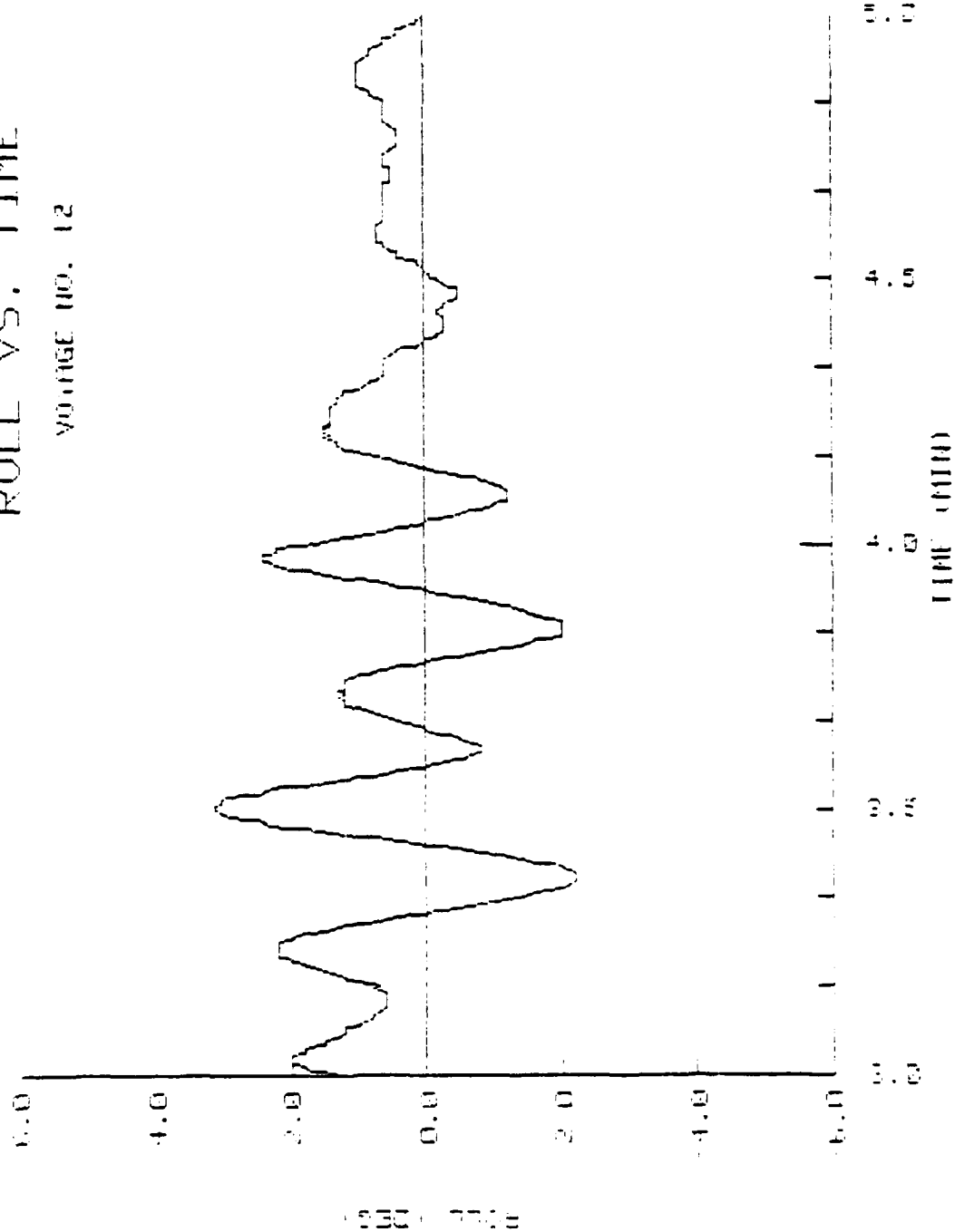


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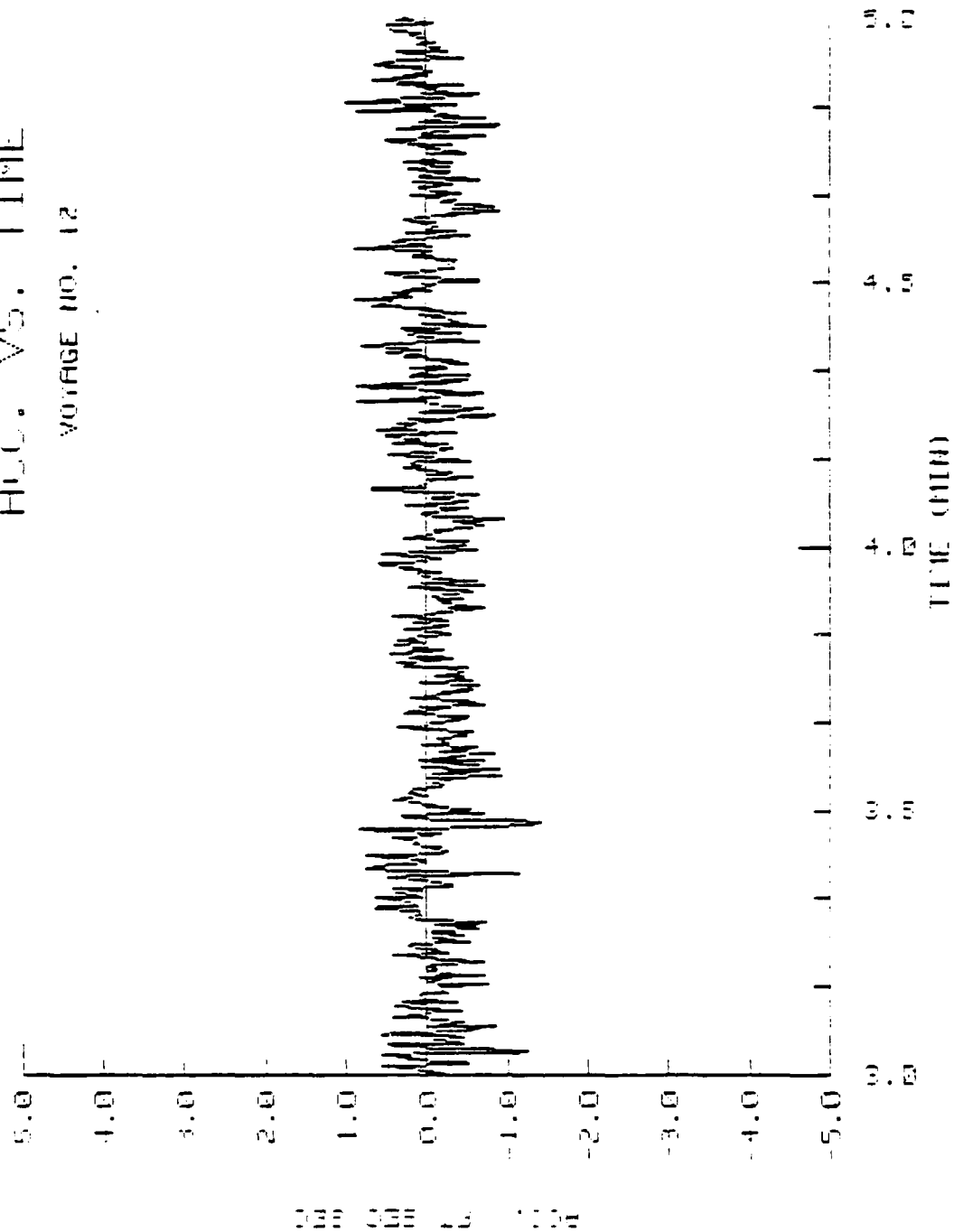
# ROLL VS. TIME

VOYAGE NO. 12



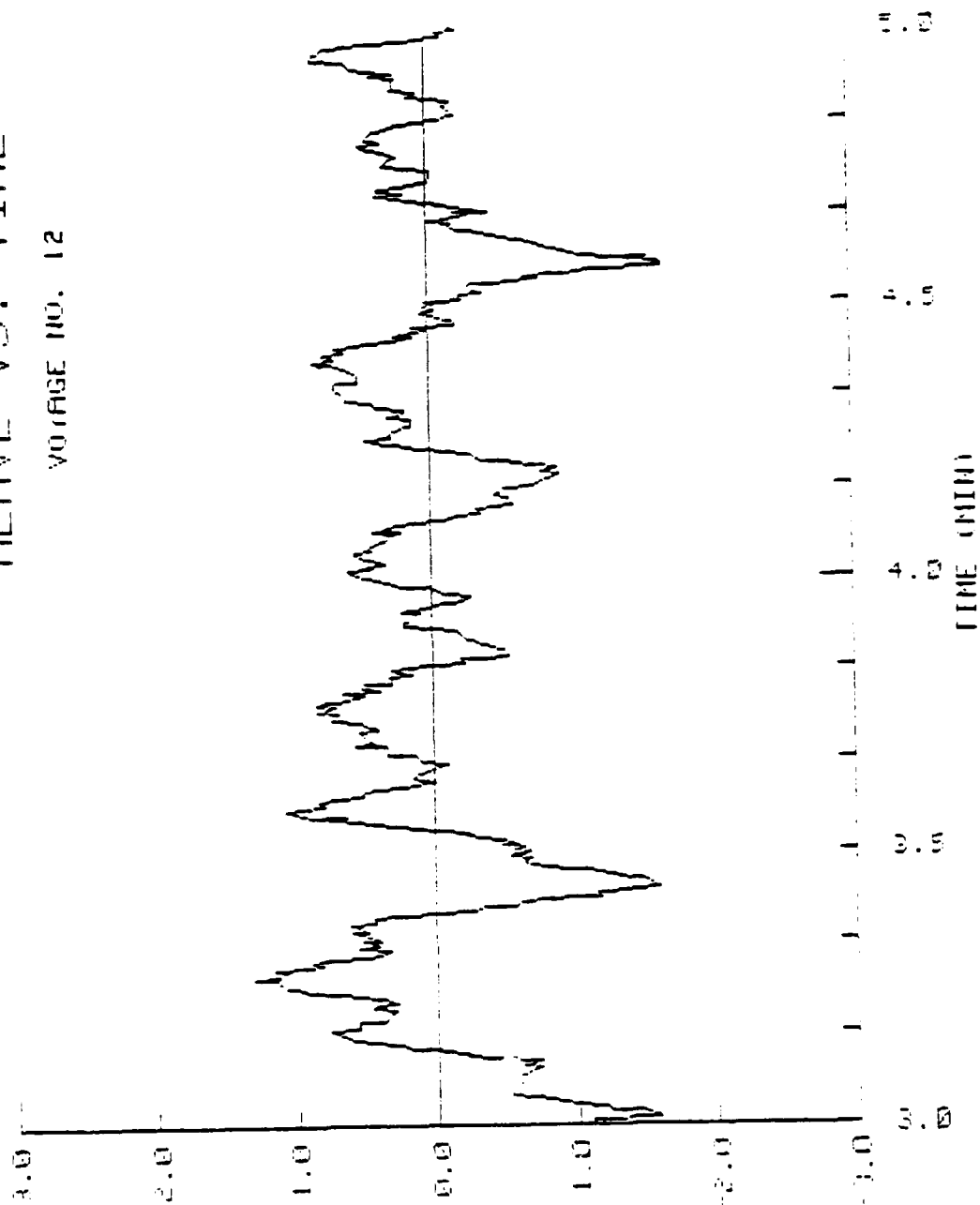


ACC. VS. TIME  
VOLTAGE NO. 12





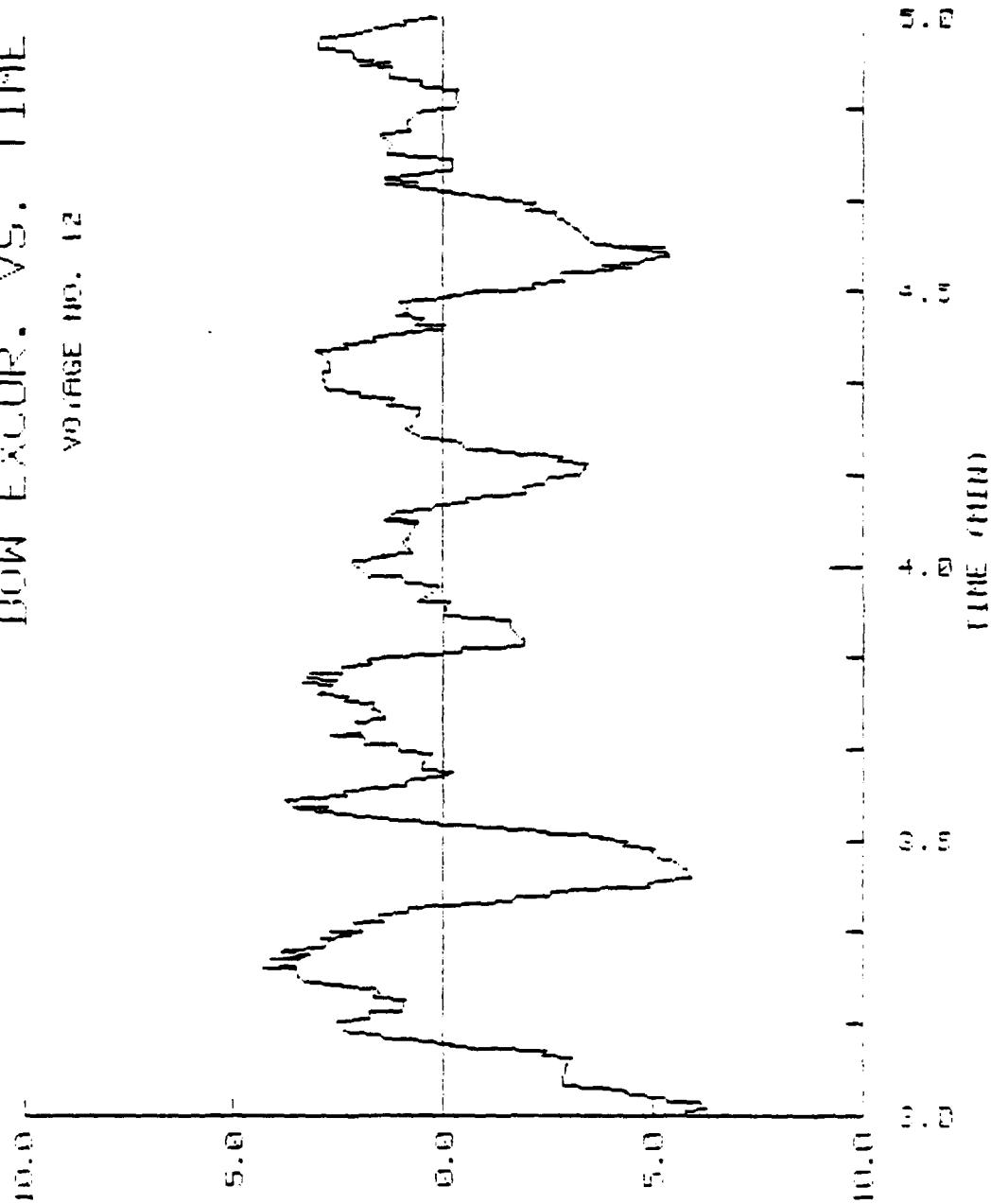
HEAVE VS. TIME  
VOLTAGE NO. 12





# BOW EXCUR. VS. TIME

VOLTAGE NO. 12

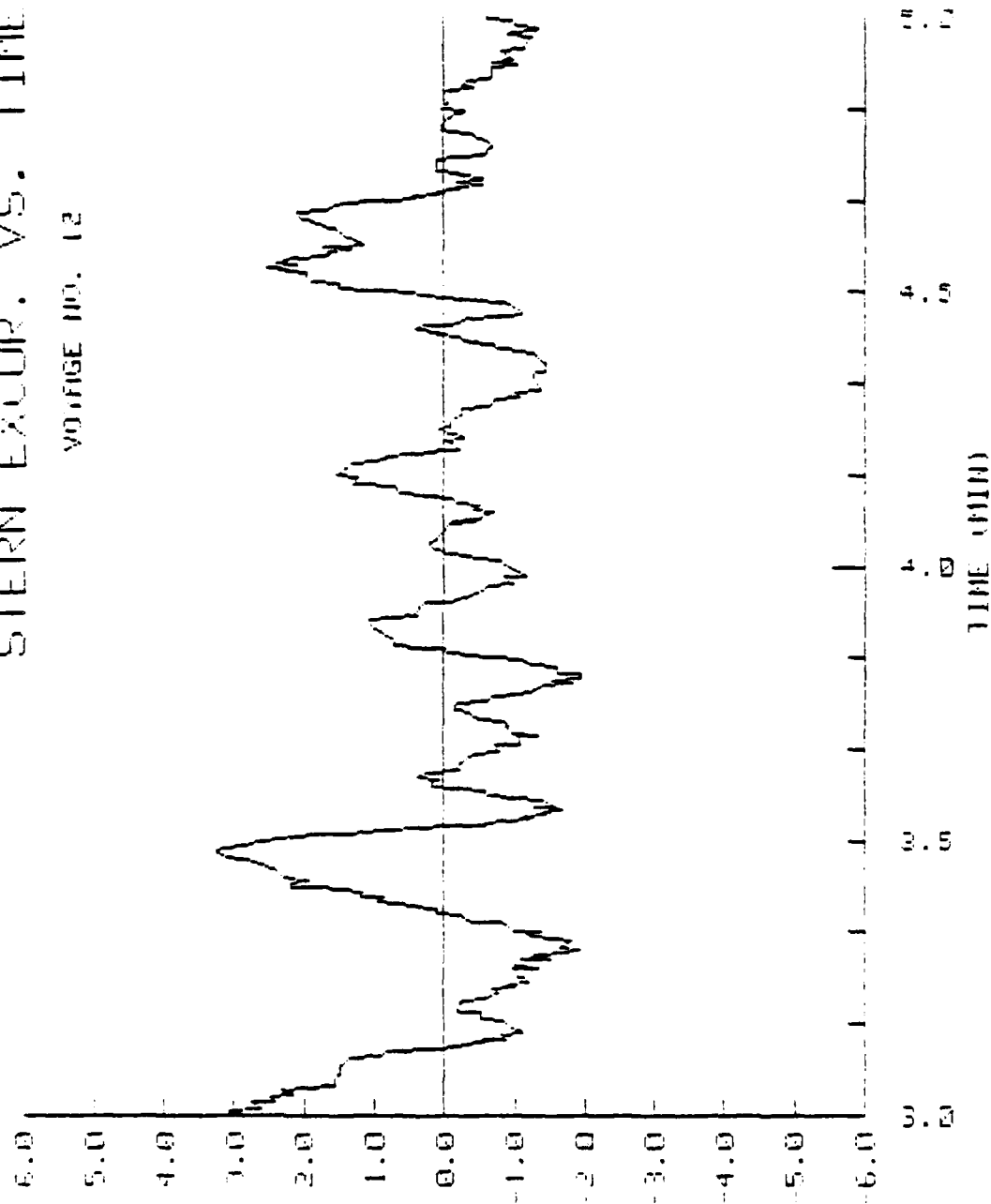


BOW EXCUR. - 91



# STERN EXCUR. VS. TIME

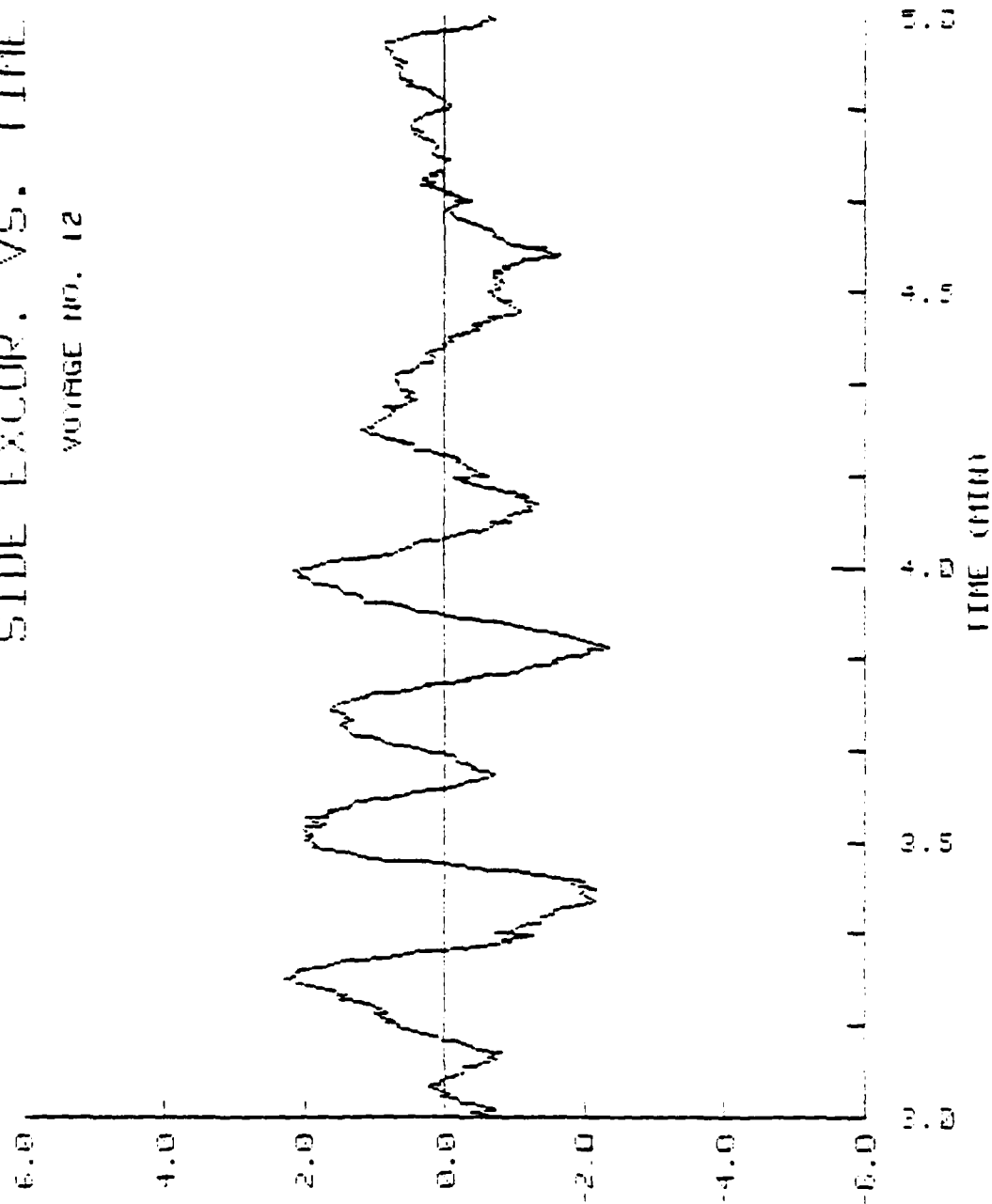
VOLUME NO. 12



STERN EXCUR. (V)



SIDE EXCUR. VS. TIME  
VOTAGE NO. 12





# STATISTICAL SUMMARY

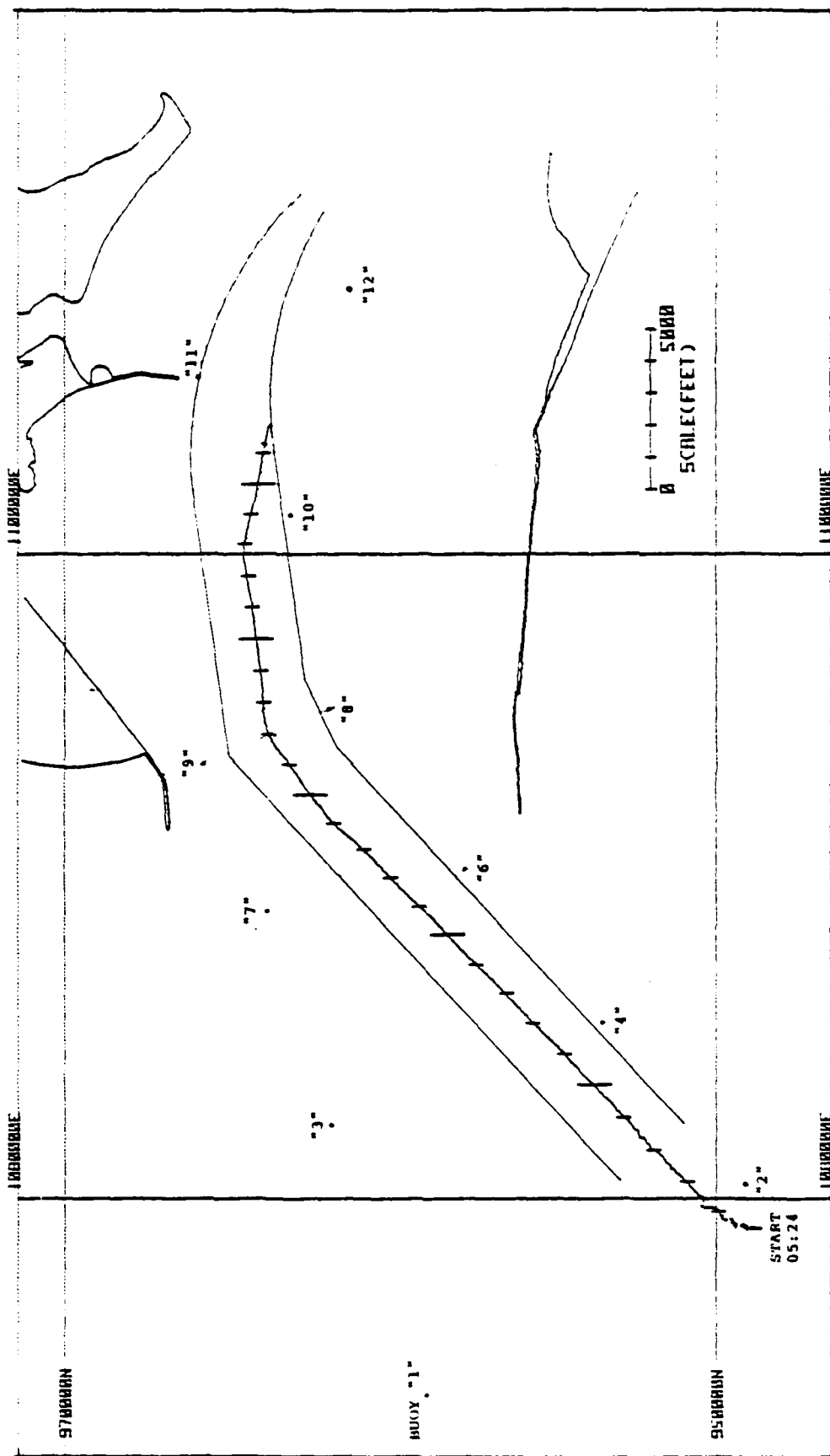
VOYAGE NO. 13

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.7	.8	.4	.4
ROLL (DEG)	.1	2.3	.8	.9
NO. (FT/SEC/SEC)	-1.1	1.2	.5	.5
HEAVE (FT)	.0	2.9	1.3	1.4
ROLL EXCUR. (FT)	.0	6.9	2.4	3.0
STERN EXCUR. (FT)	.0	2.7	1.0	1.2
SIDE EXCUR (FT)	.0	3.9	1.5	1.7



# VIIYAGE NO. 13 SHIP TRACK

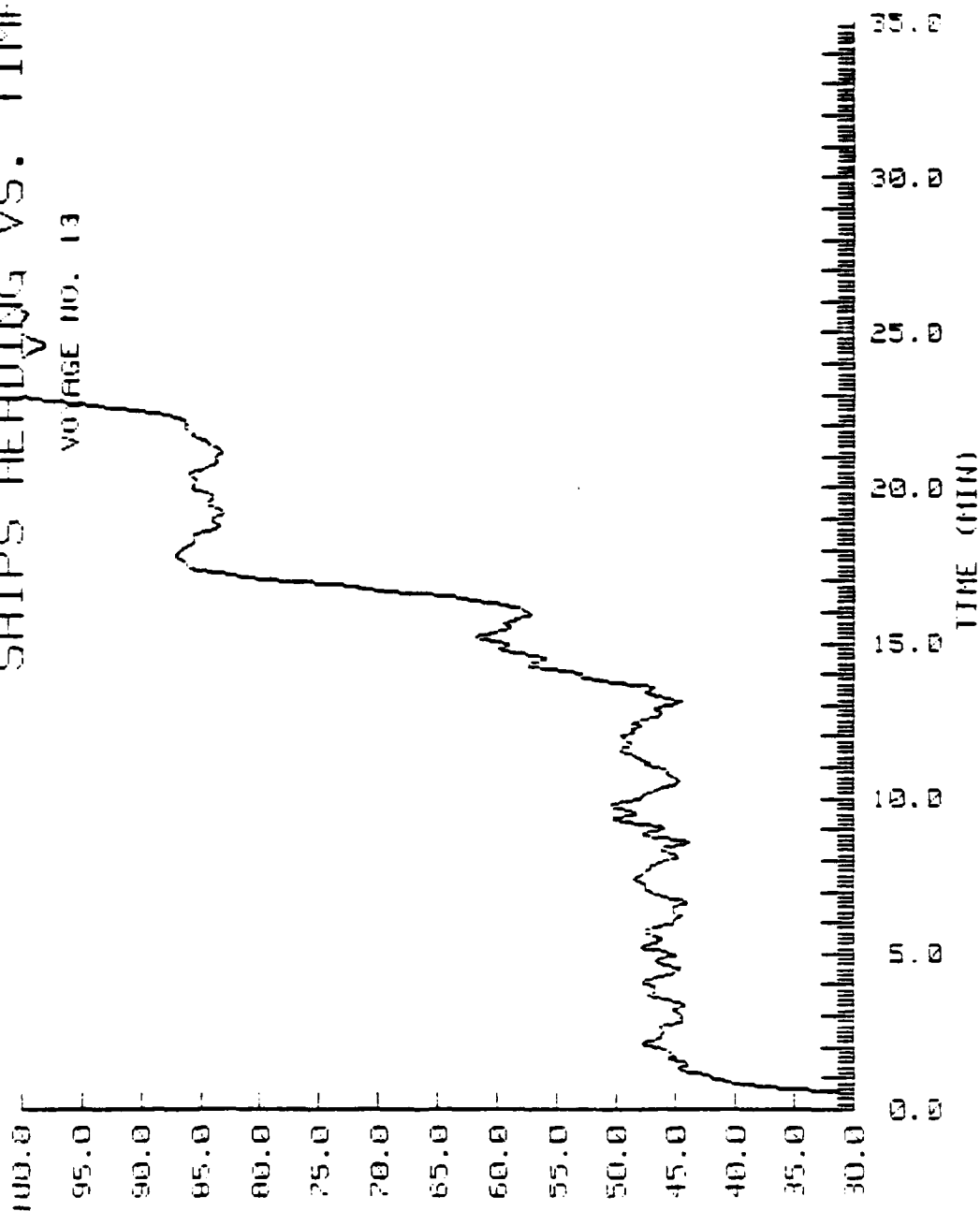
SCALE : 1 INCH = 5000 FEET





# SHIPS HEADING VS. TIME

VOYAGE NO. 13

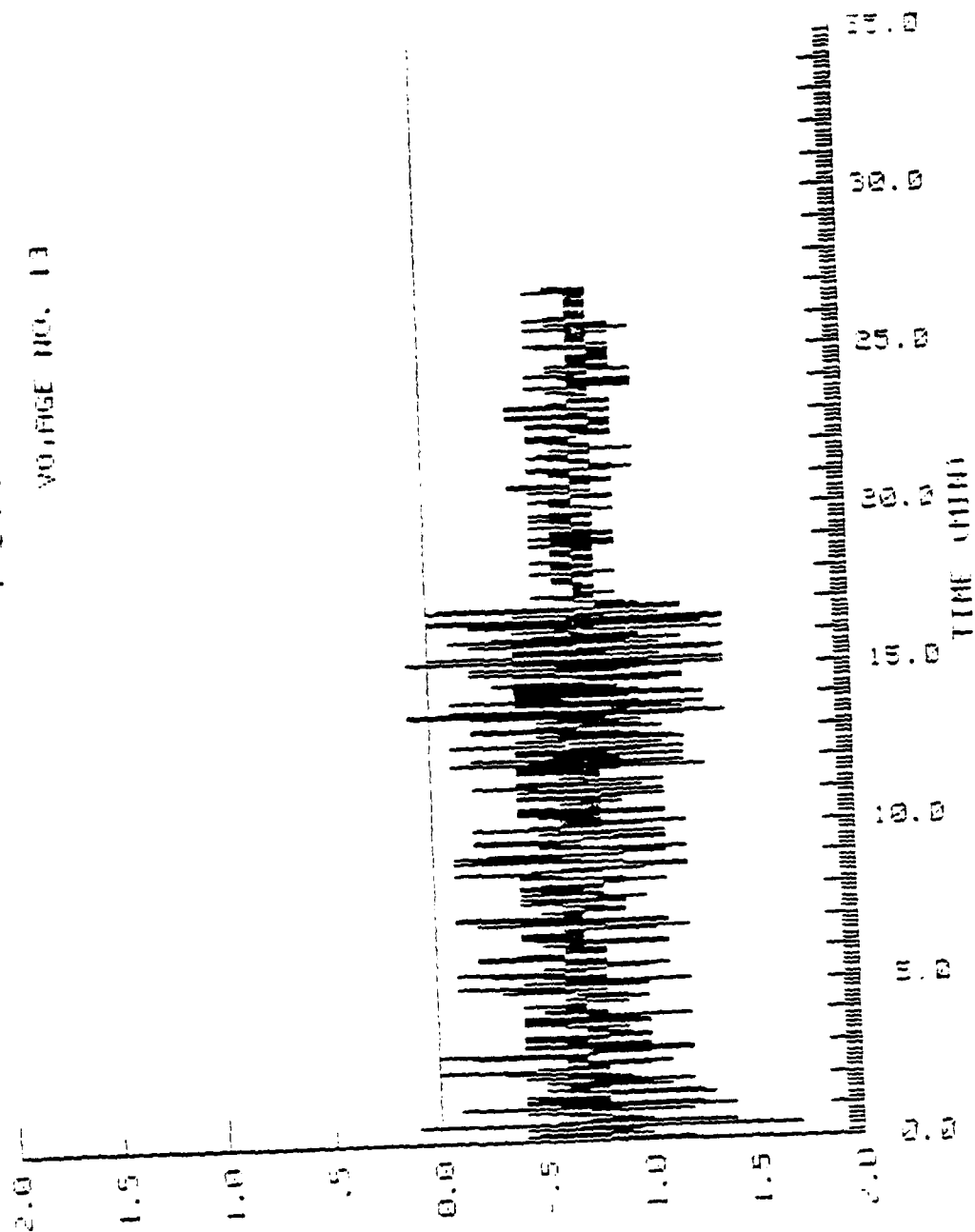


SHIPS HEADING (DEG)



# PITCH VS. TIME

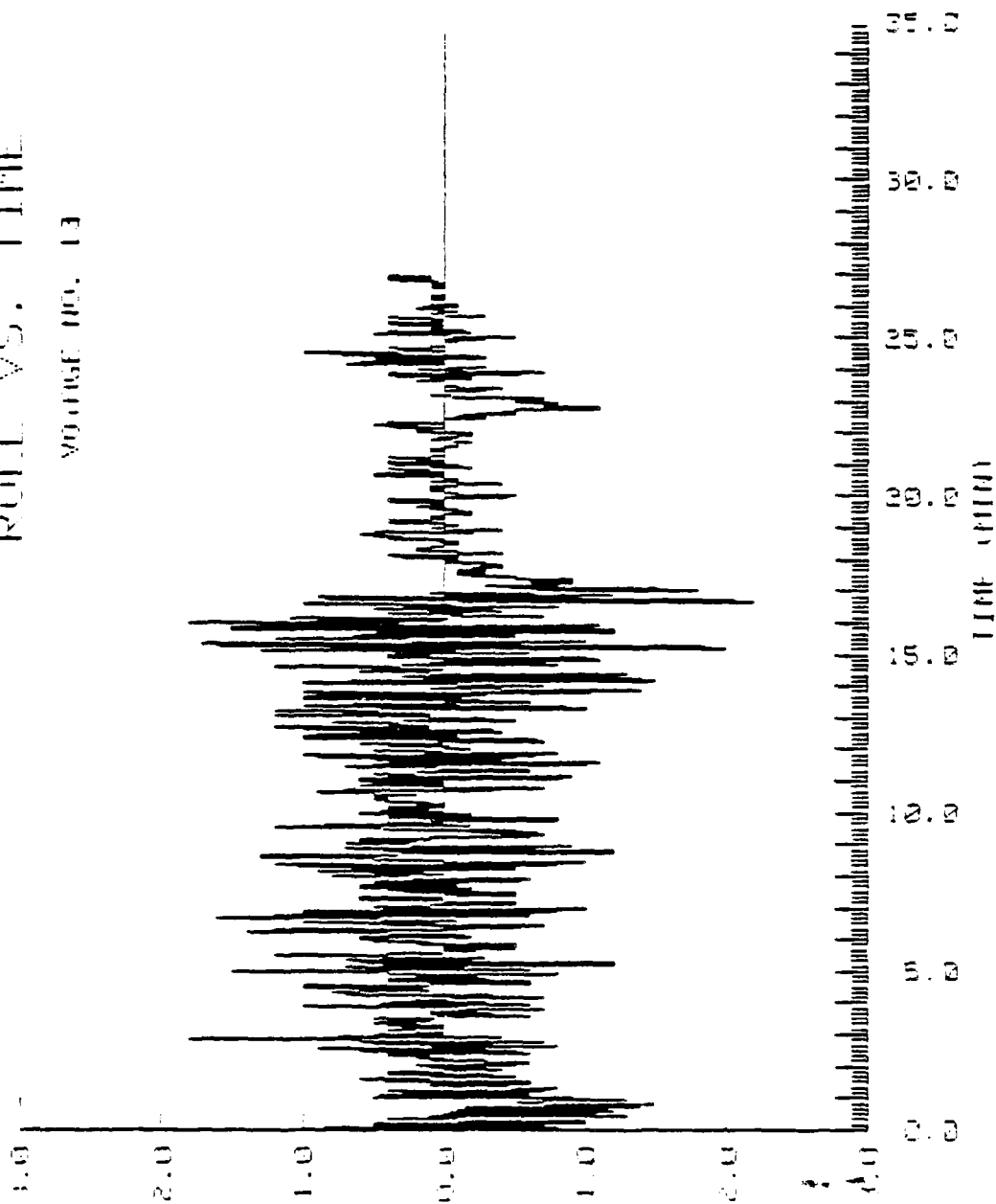
VOICE NO. 13





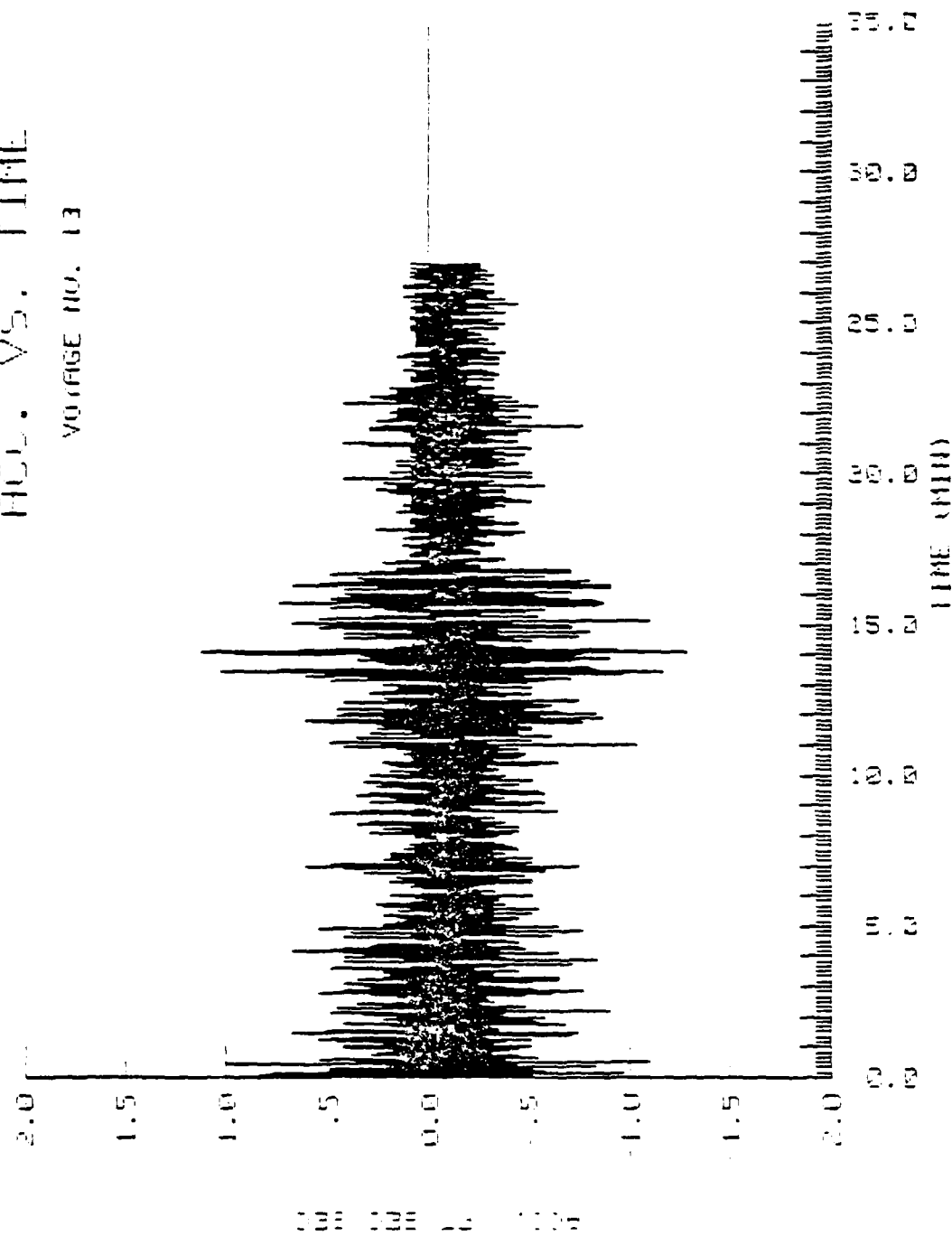
# ROLL VS. TIME

VOYAGE NO. 13





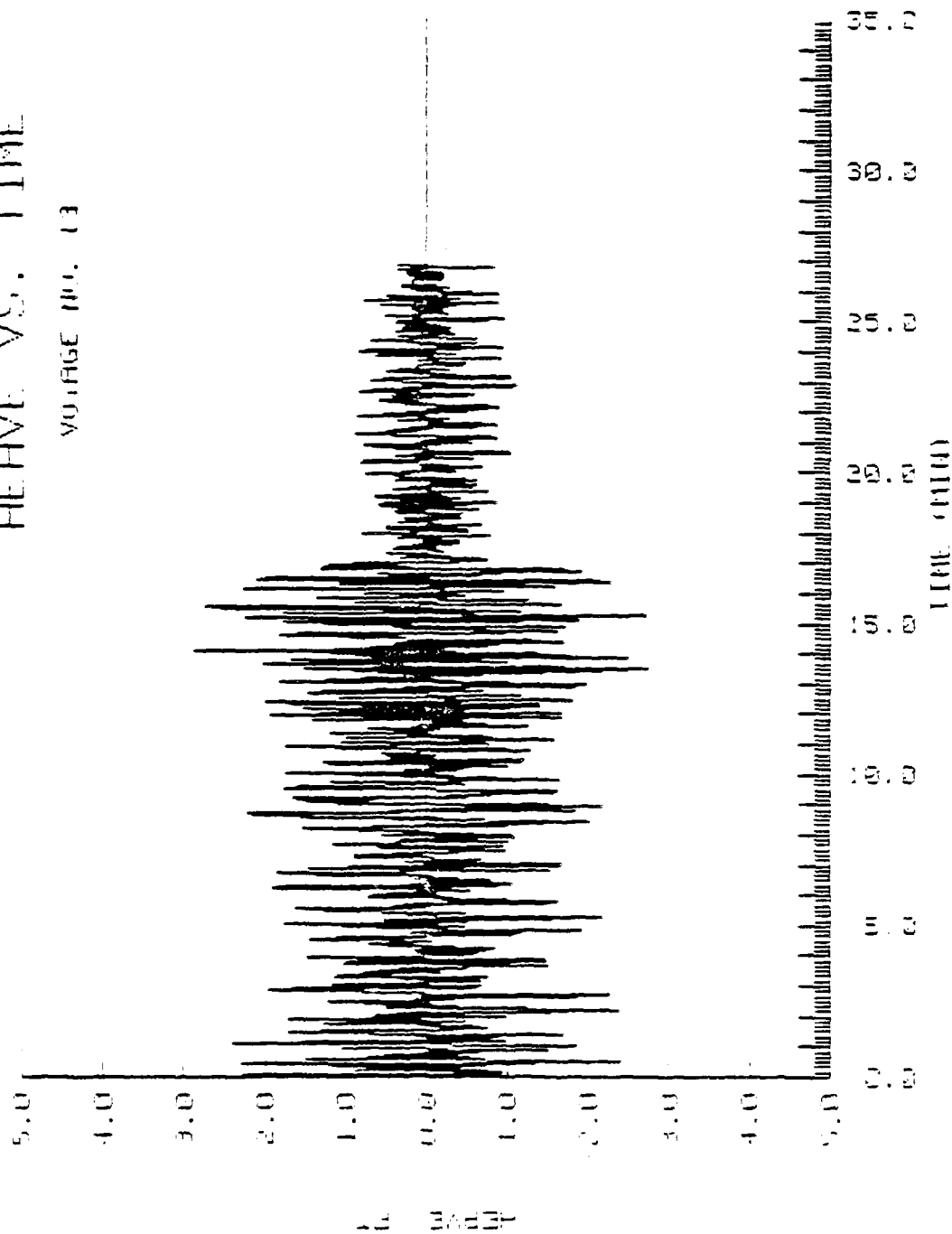
REC. VS. TIME  
VOIAGE NO. 13





# HEAVE VS. TIME

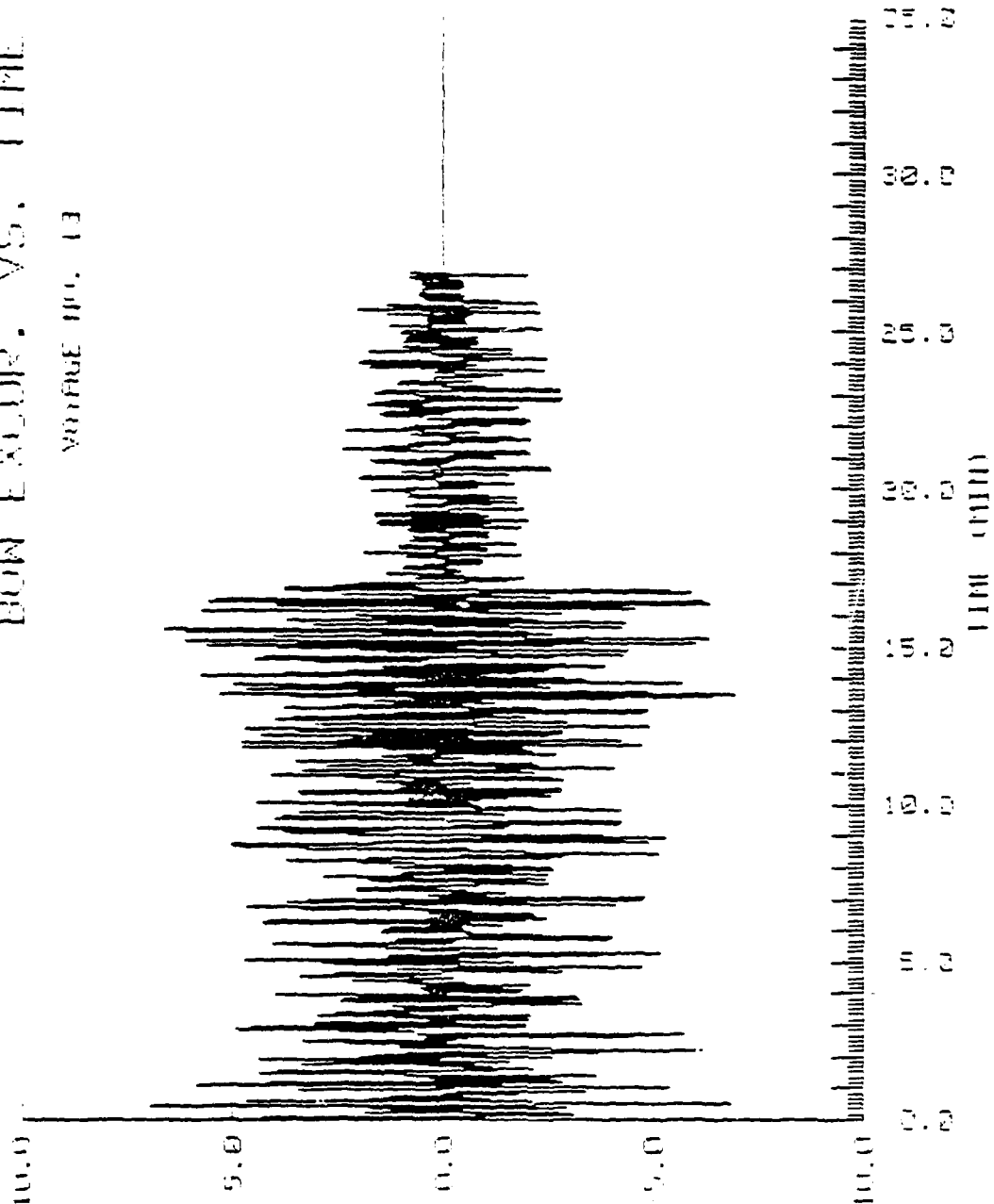
VOLTAGE (mV) (3)





# BOW EXCUR. VS. TIME

VOLTAGE 100. 13





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TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX DACW57-78-C-0028

TETRAT-TC-3925-APP-A(1)

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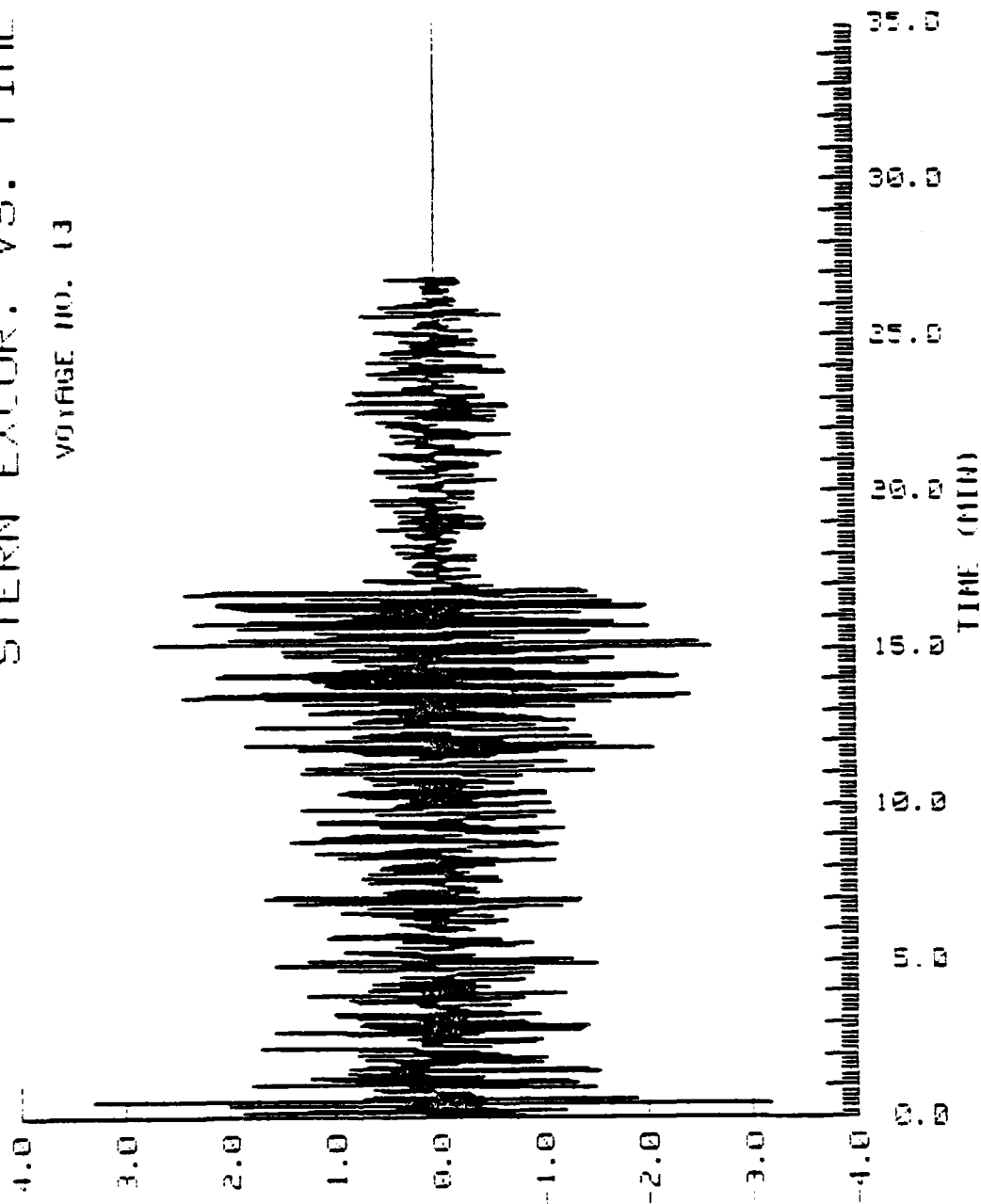
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# STERN EXCUR. VS. TIME

VOYAGE NO. 13

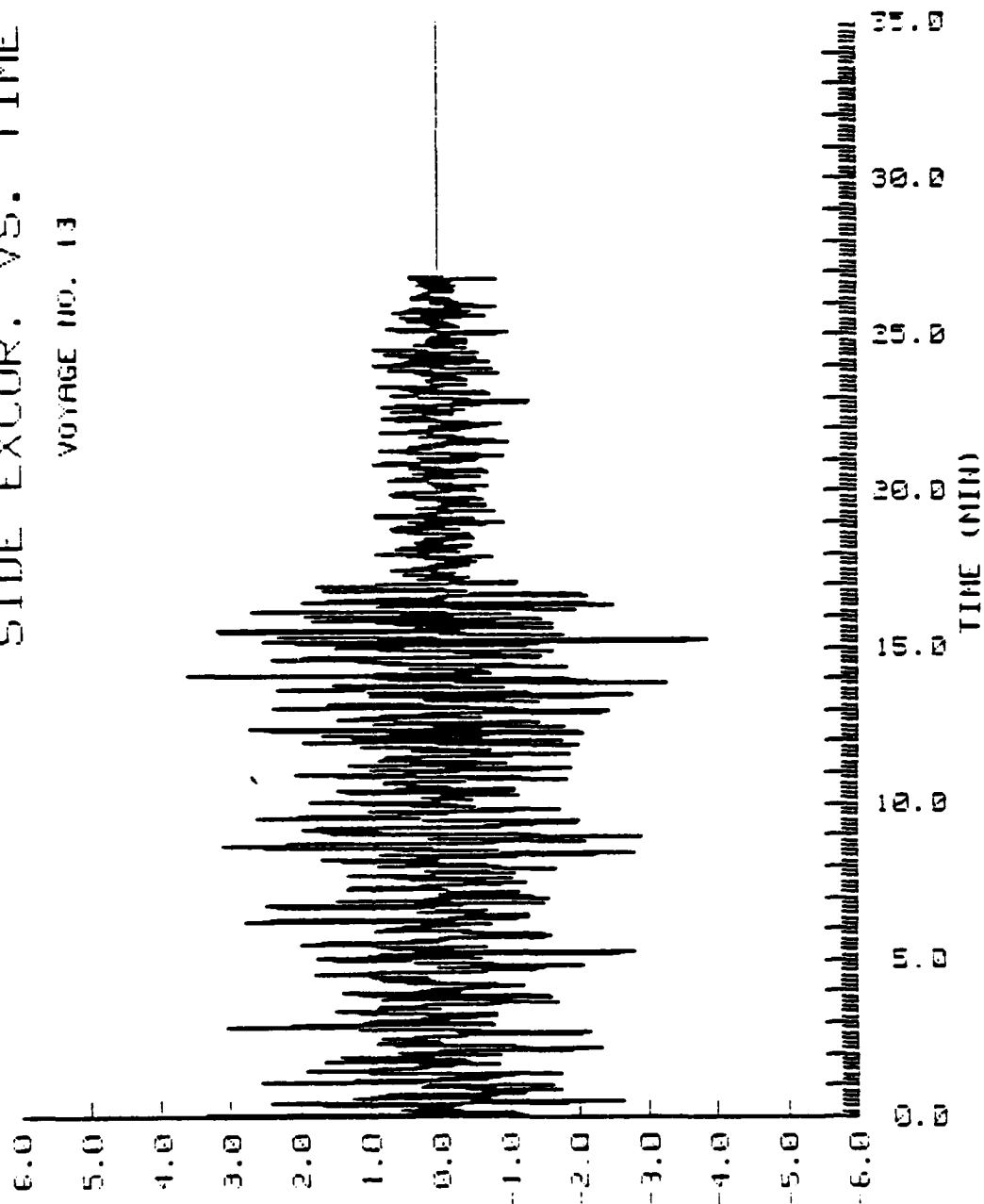


STERN EXCUR. (ST)



# SIDE EXCUR. VS. TIME

VOYAGE NO. 13

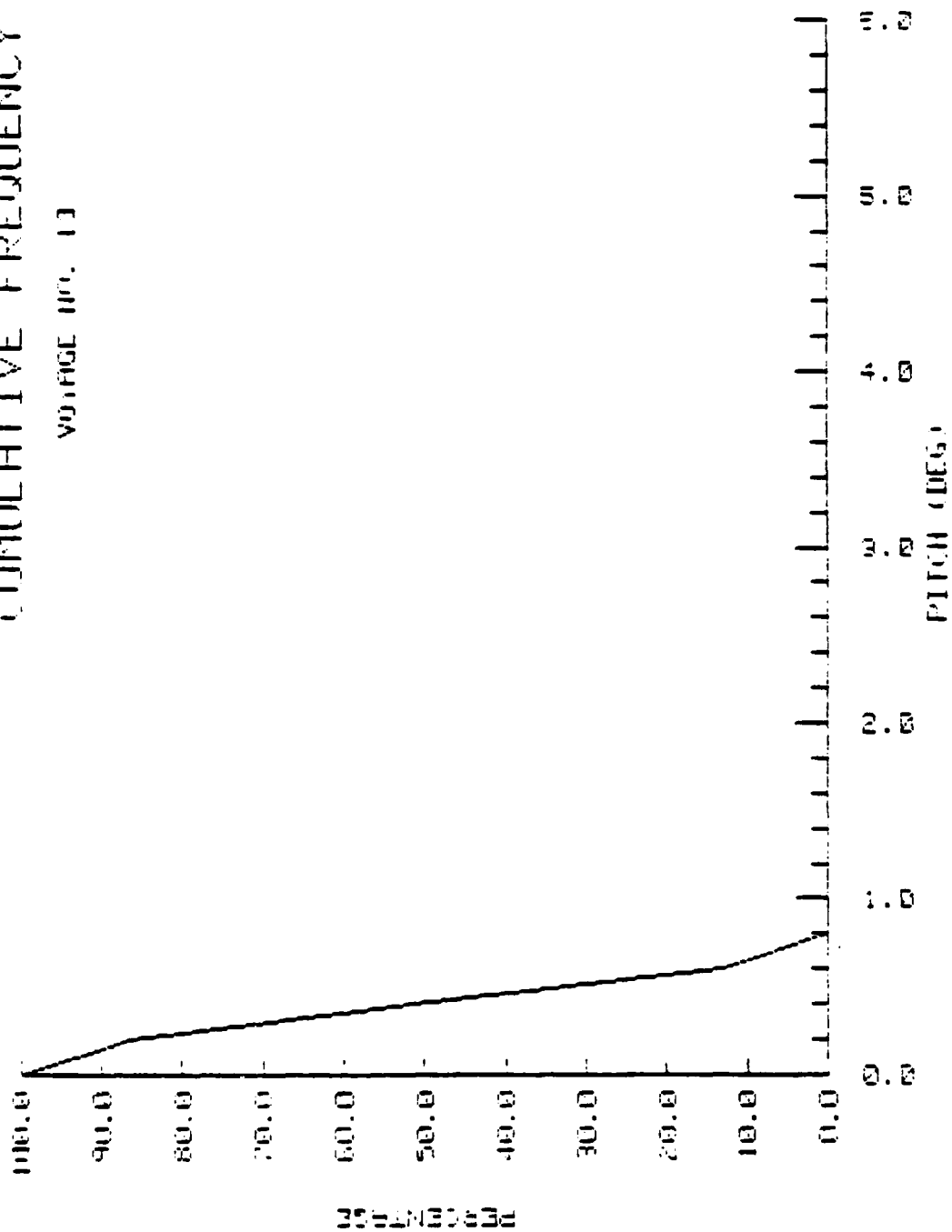


13) VOYAGE NO. 13



# CUMULATIVE FREQUENCY

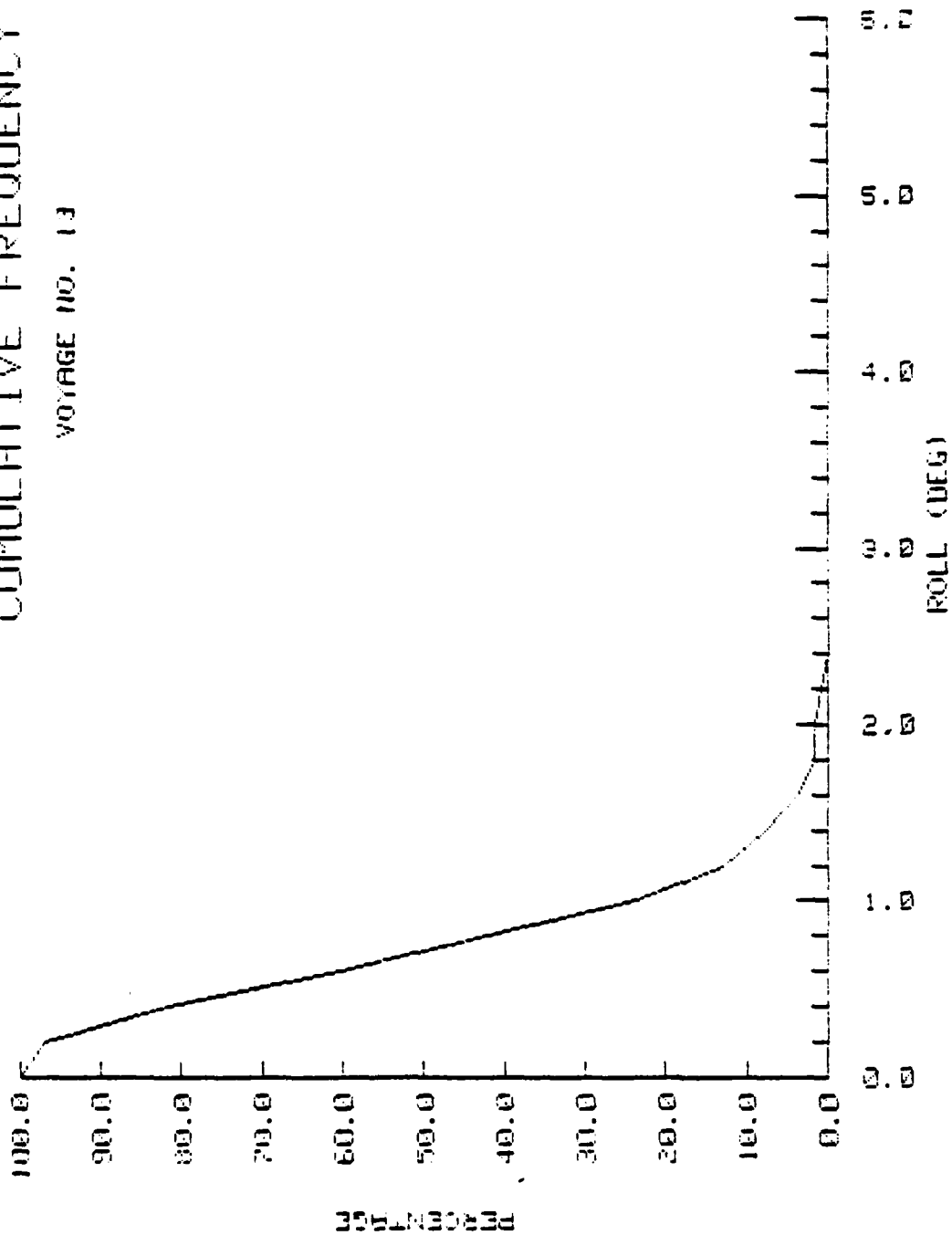
VOLUME NO. 13





# CUMULATIVE FREQUENCY

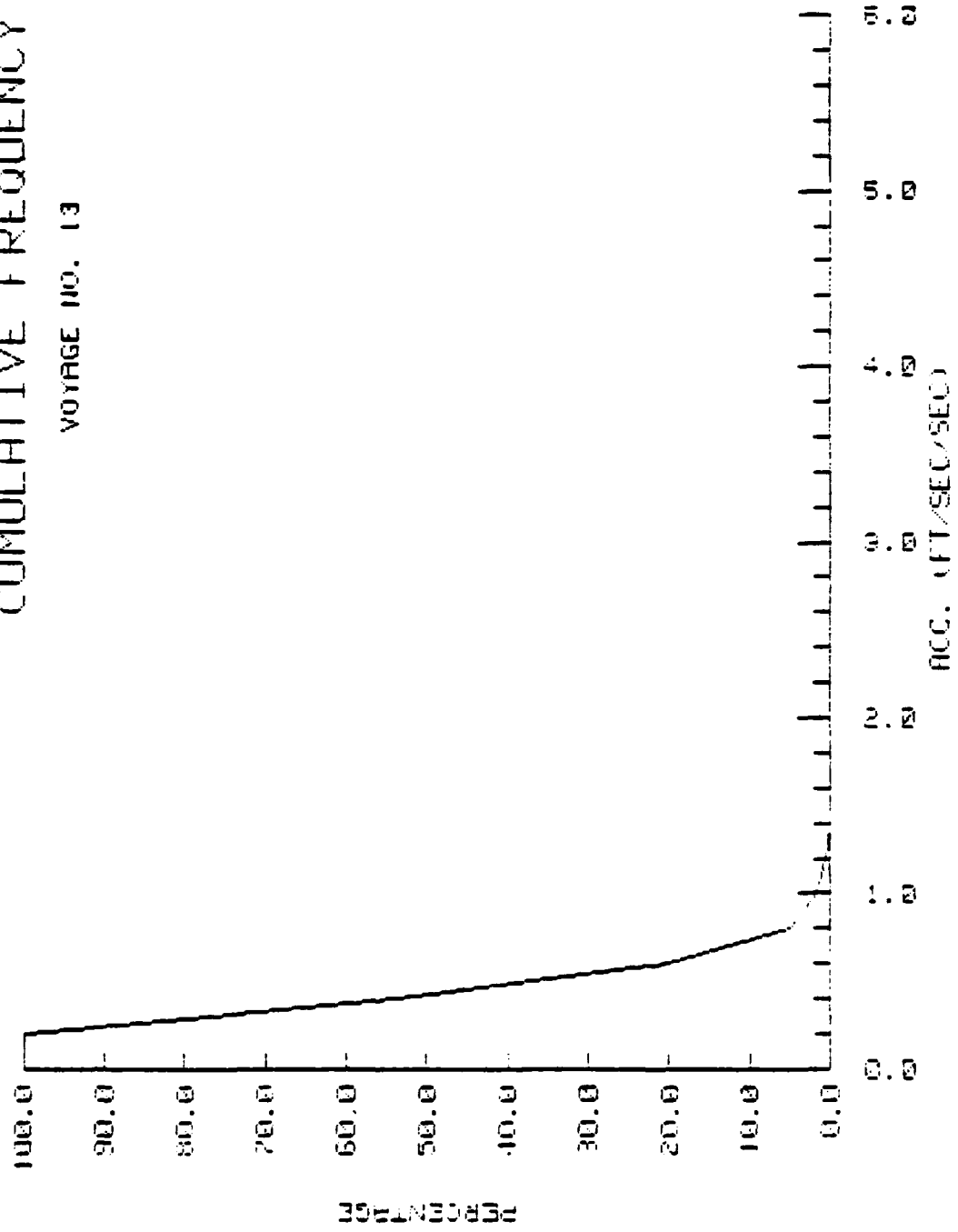
VOYAGE NO. 13





# CUMULATIVE FREQUENCY

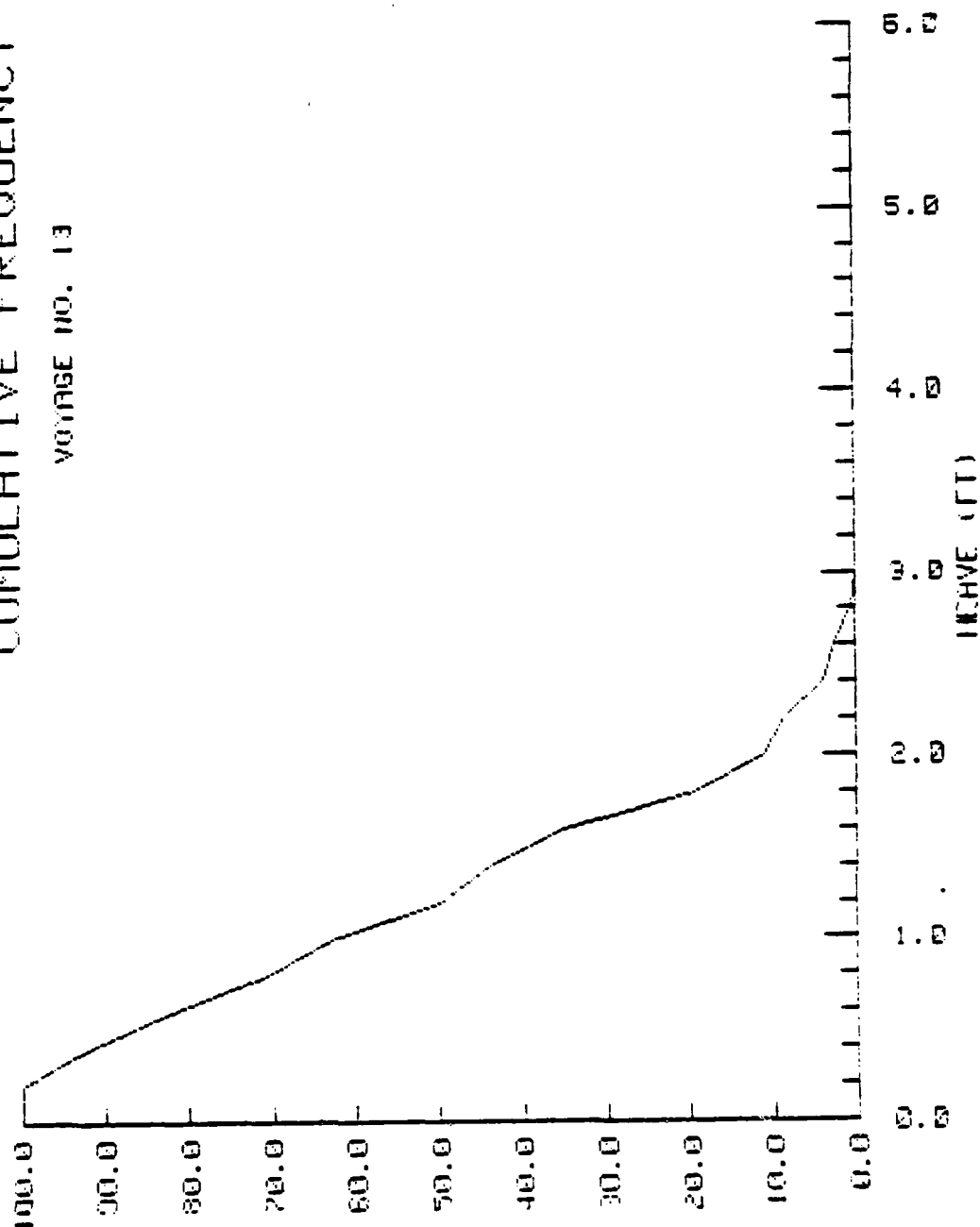
VOYAGE NO. 13





# CUMULATIVE FREQUENCY

VOYAGE NO. 13

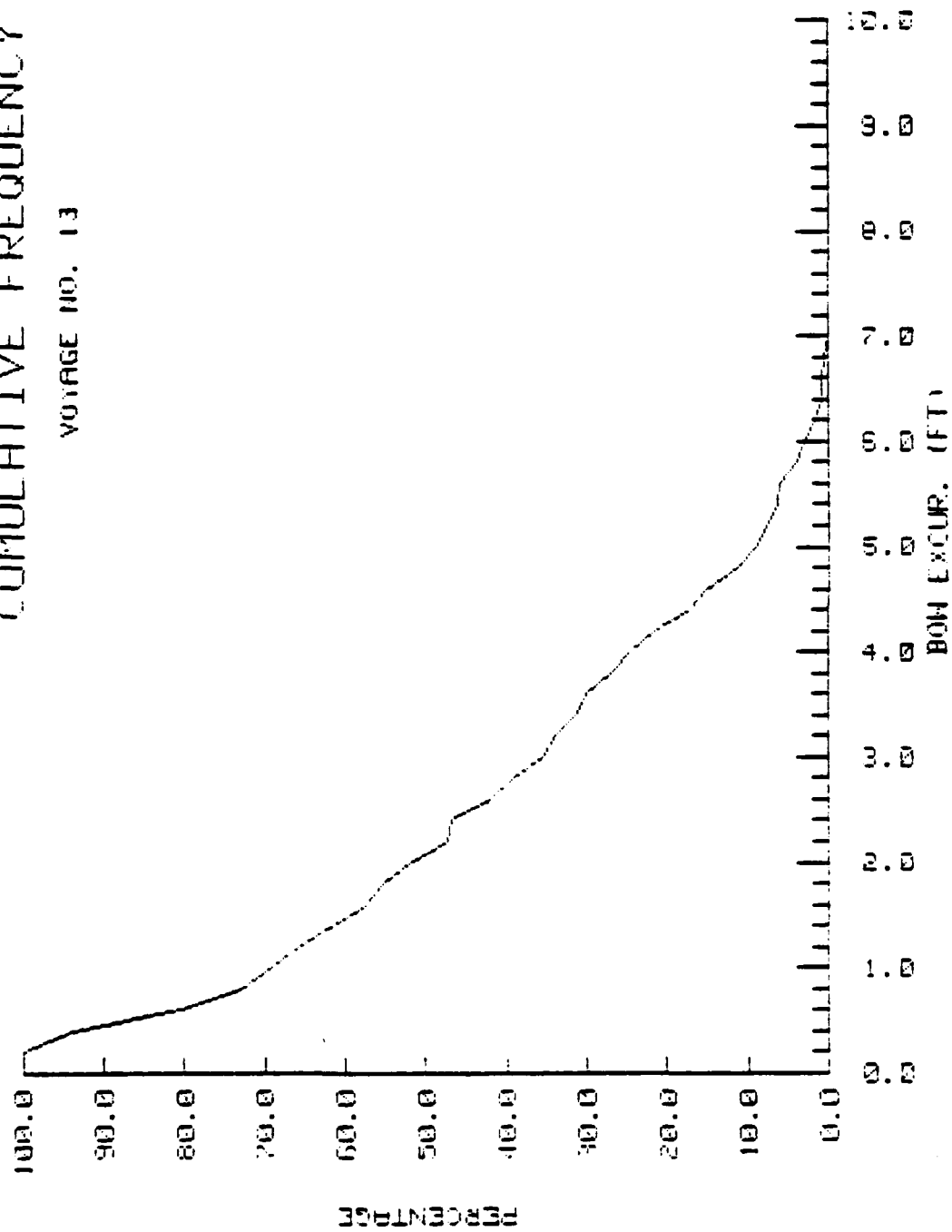


5501-200831



# CUMULATIVE FREQUENCY

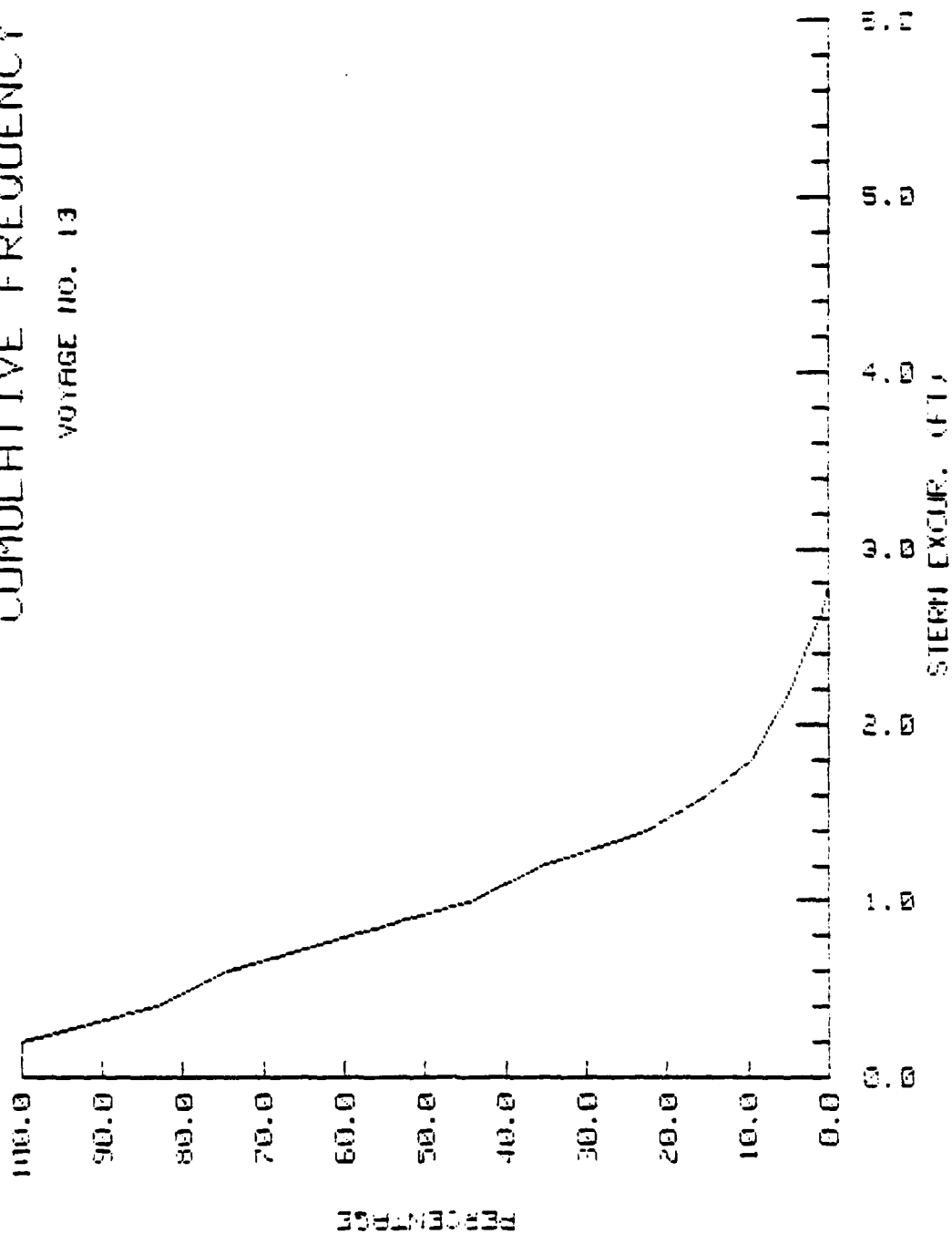
VOTAGE NO. 13





# CUMULATIVE FREQUENCY

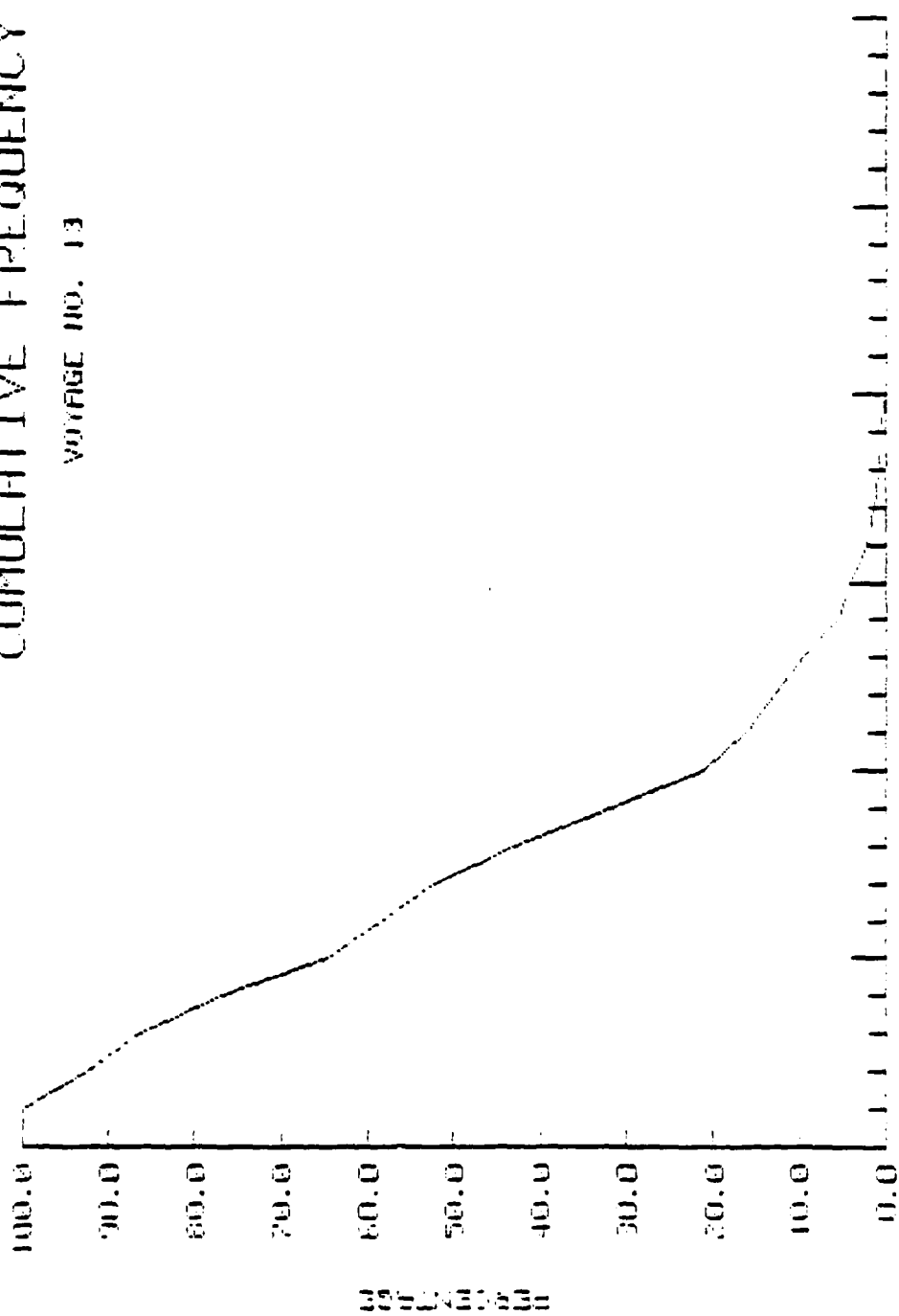
VOYAGE NO. 13





# CUMULATIVE FREQUENCY

VOTAGE NO. 13



0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0

SIDE PAPER. (11)



# STATISTICAL SUMMARY

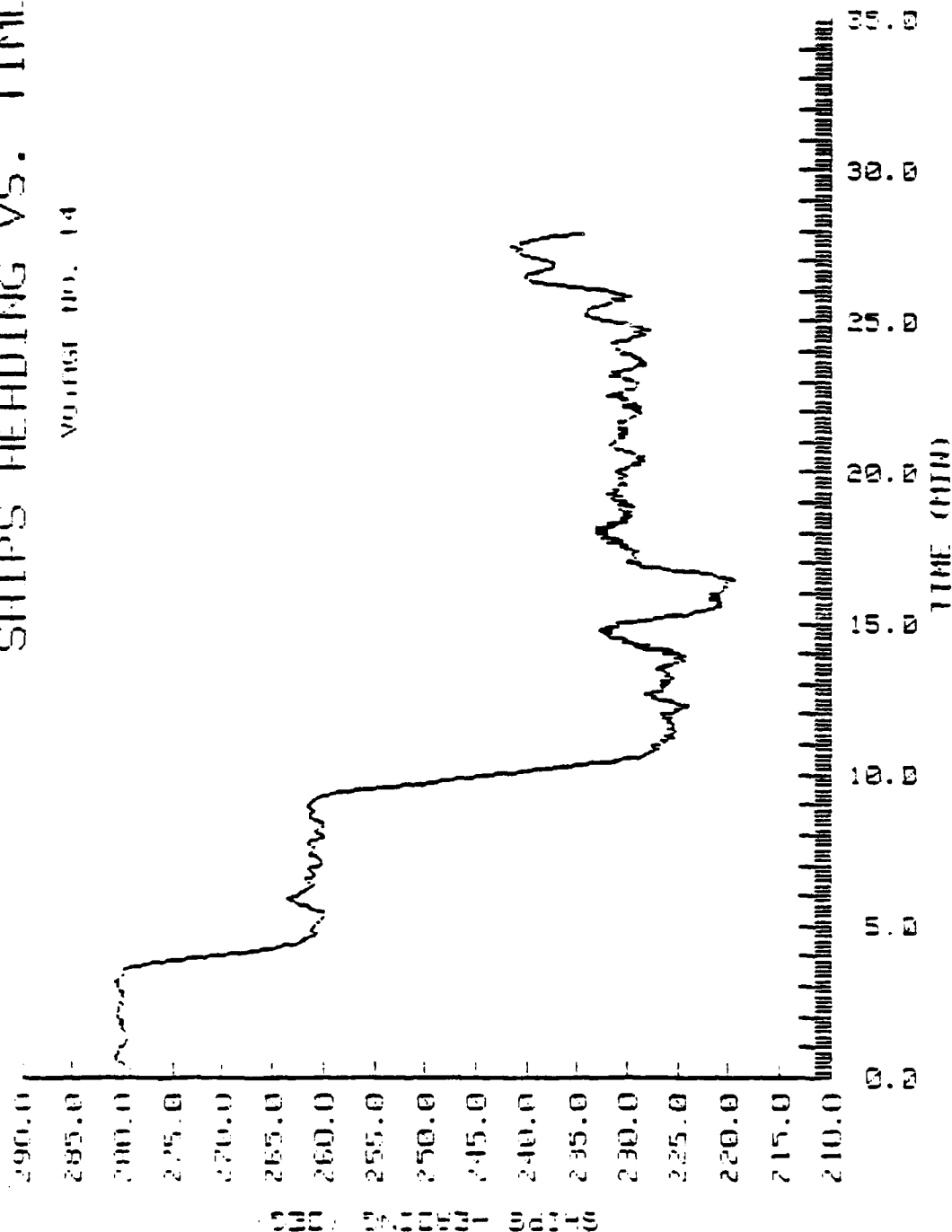
VOYAGE NO. 14

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.1	2.9	1.2	1.3
ROLL (DEG)	.4	13.4	3.7	4.3
YAW (FT SEC SEC)	-1.1	5.5	1.9	2.2
HEAVE (FT)	.1	8.4	3.1	3.5
ROLL EXCUR. (FT)	.1	22.6	8.5	9.7
YAW EXCUR. (FT)	.1	12.1	4.5	5.1
HEAVE EXCUR. (FT)	.1	10.1	3.2	3.6



# SHIPS HEADING VS. TIME

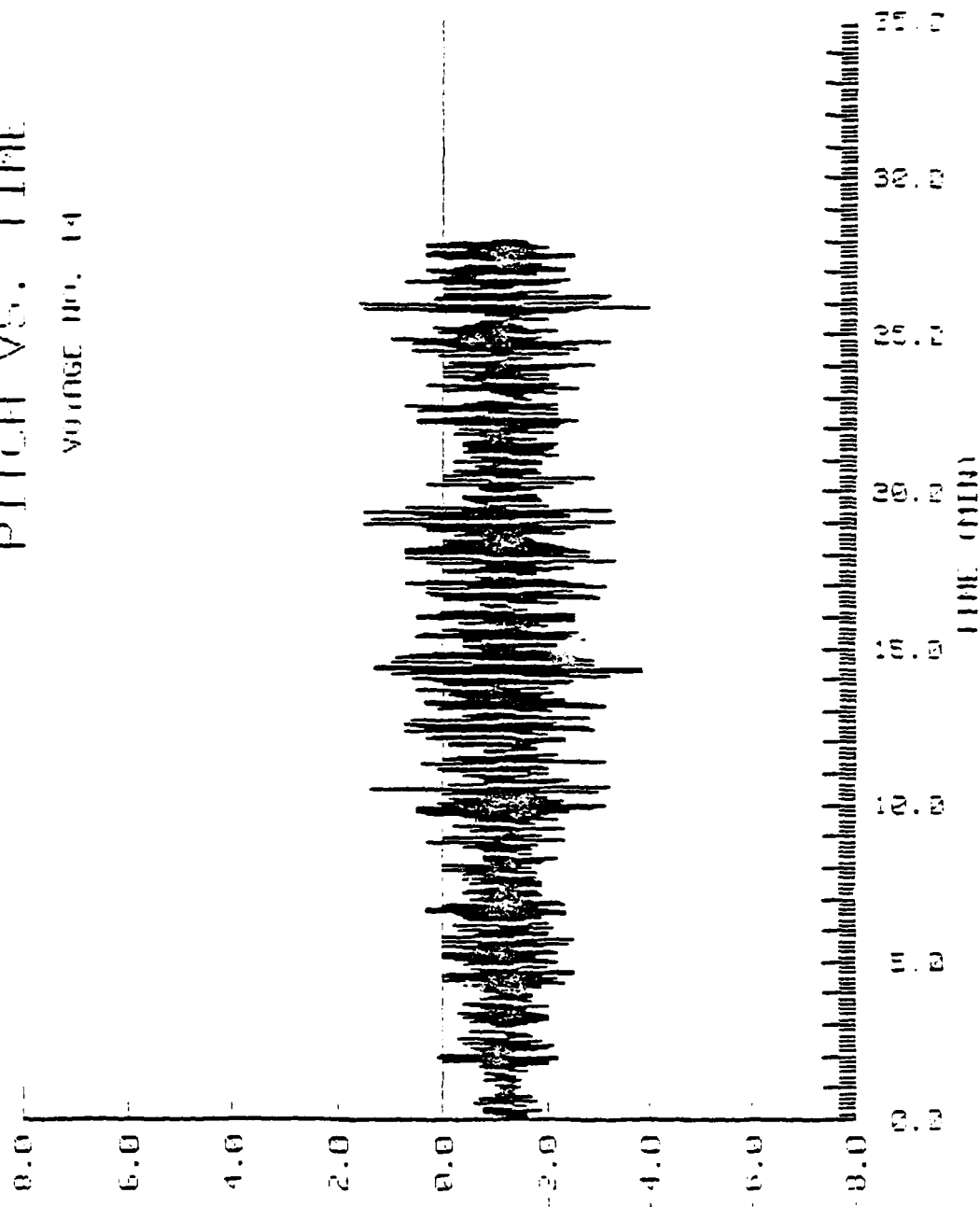
VOYAGE NO. 14





# PITCH VS. TIME

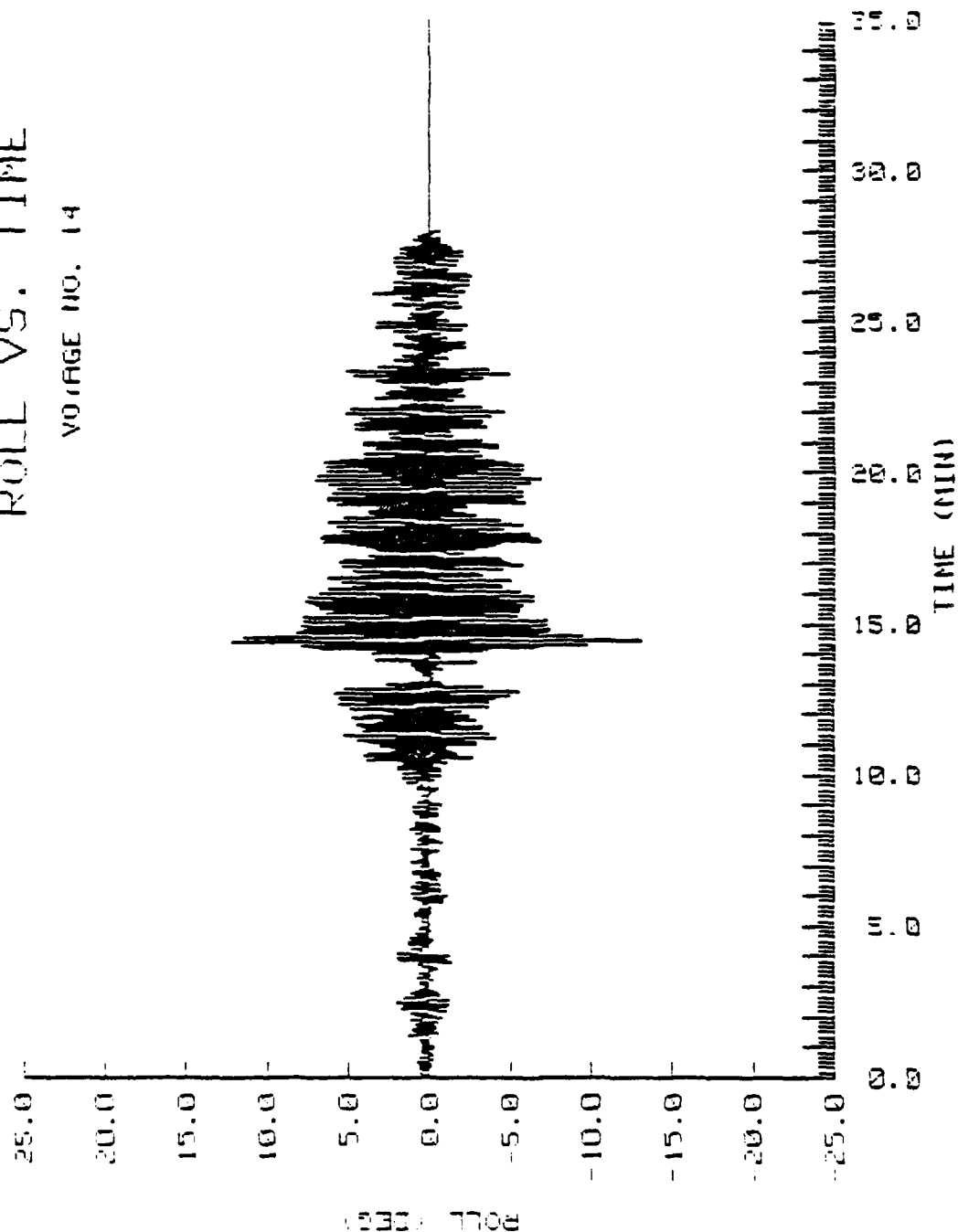
VOLUME 100, 14





# ROLL VS. TIME

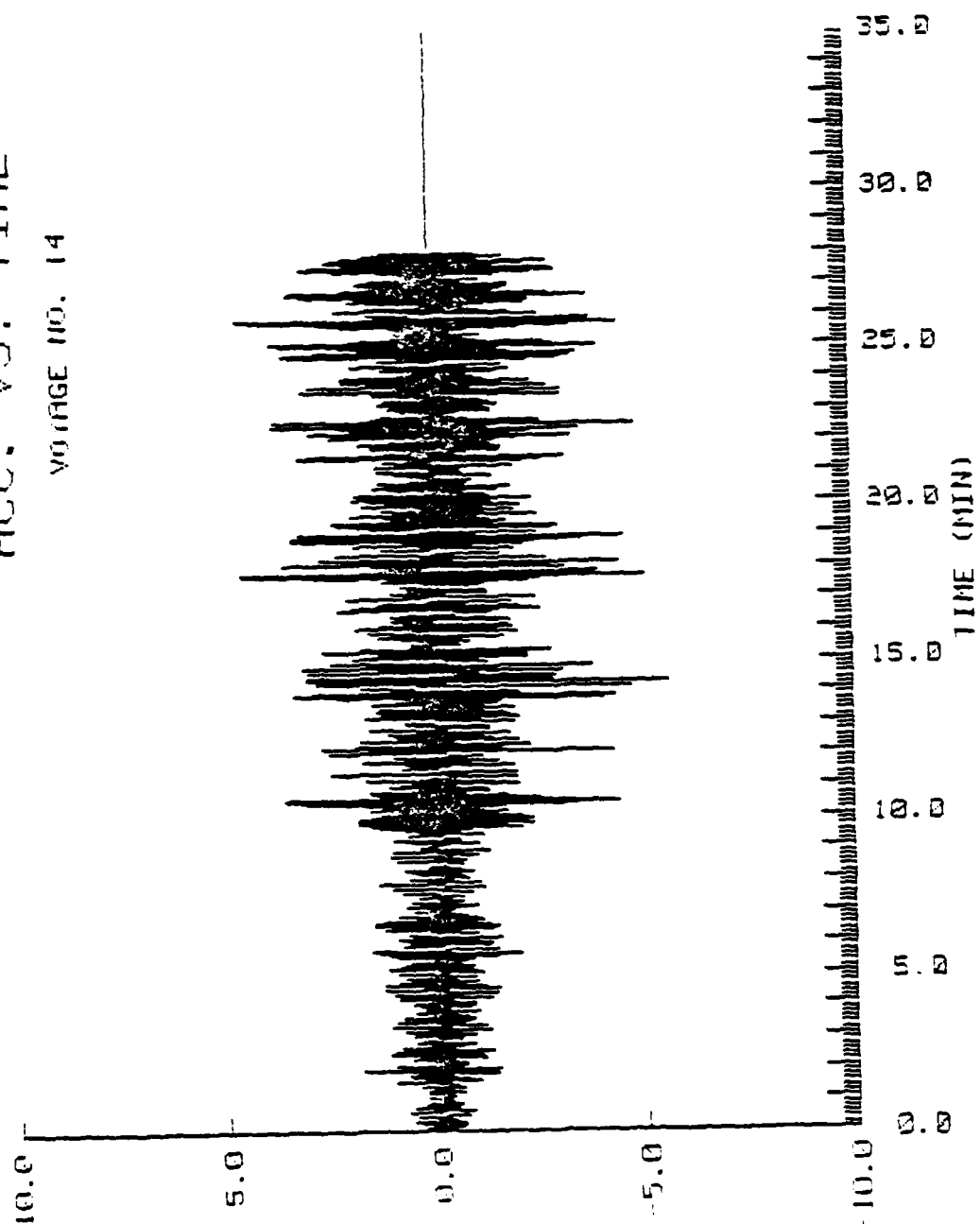
VOLUME NO. 14





ACC. VS. TIME

VOLUME NO. 14

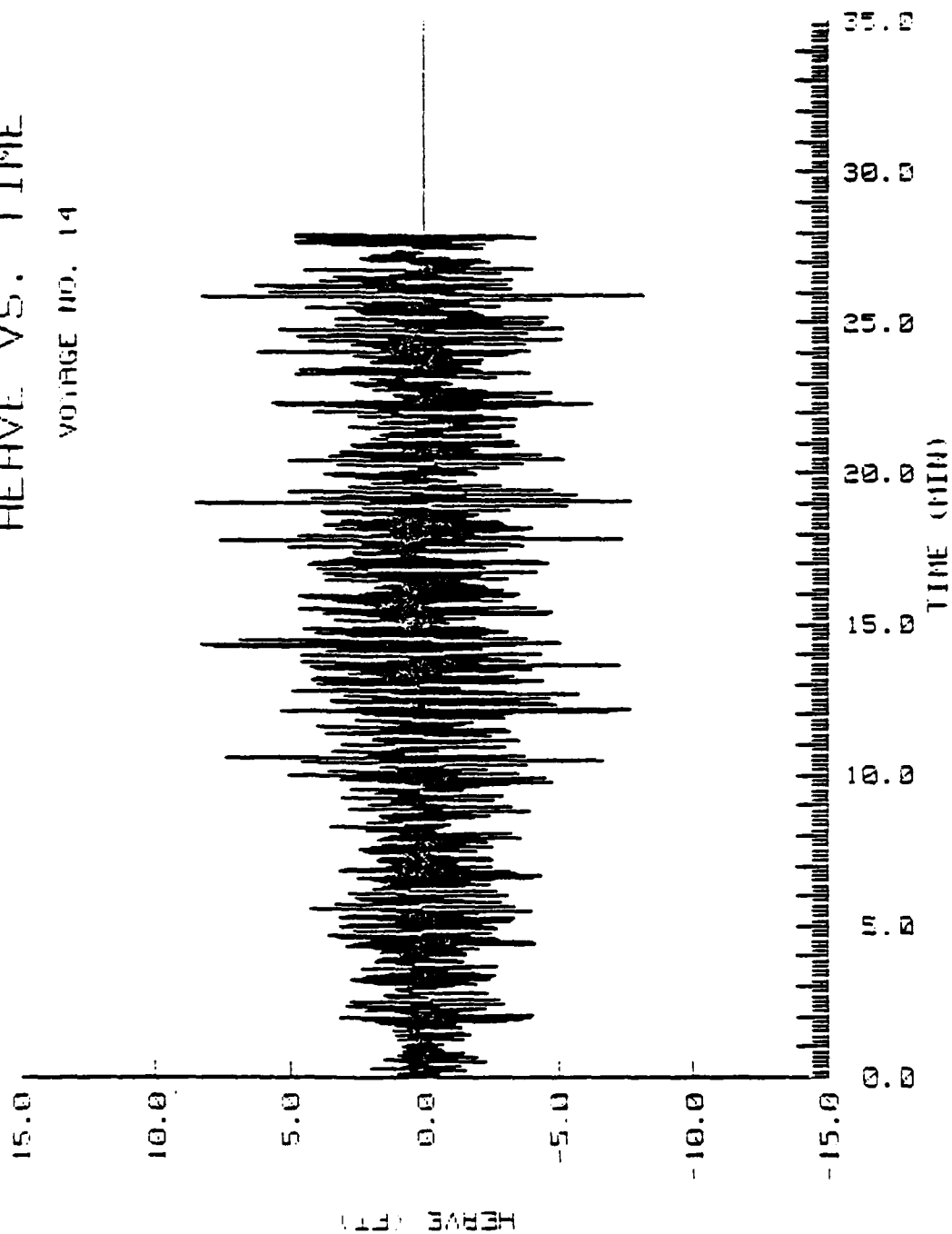


ACC. VS. TIME



# HEAVE VS. TIME

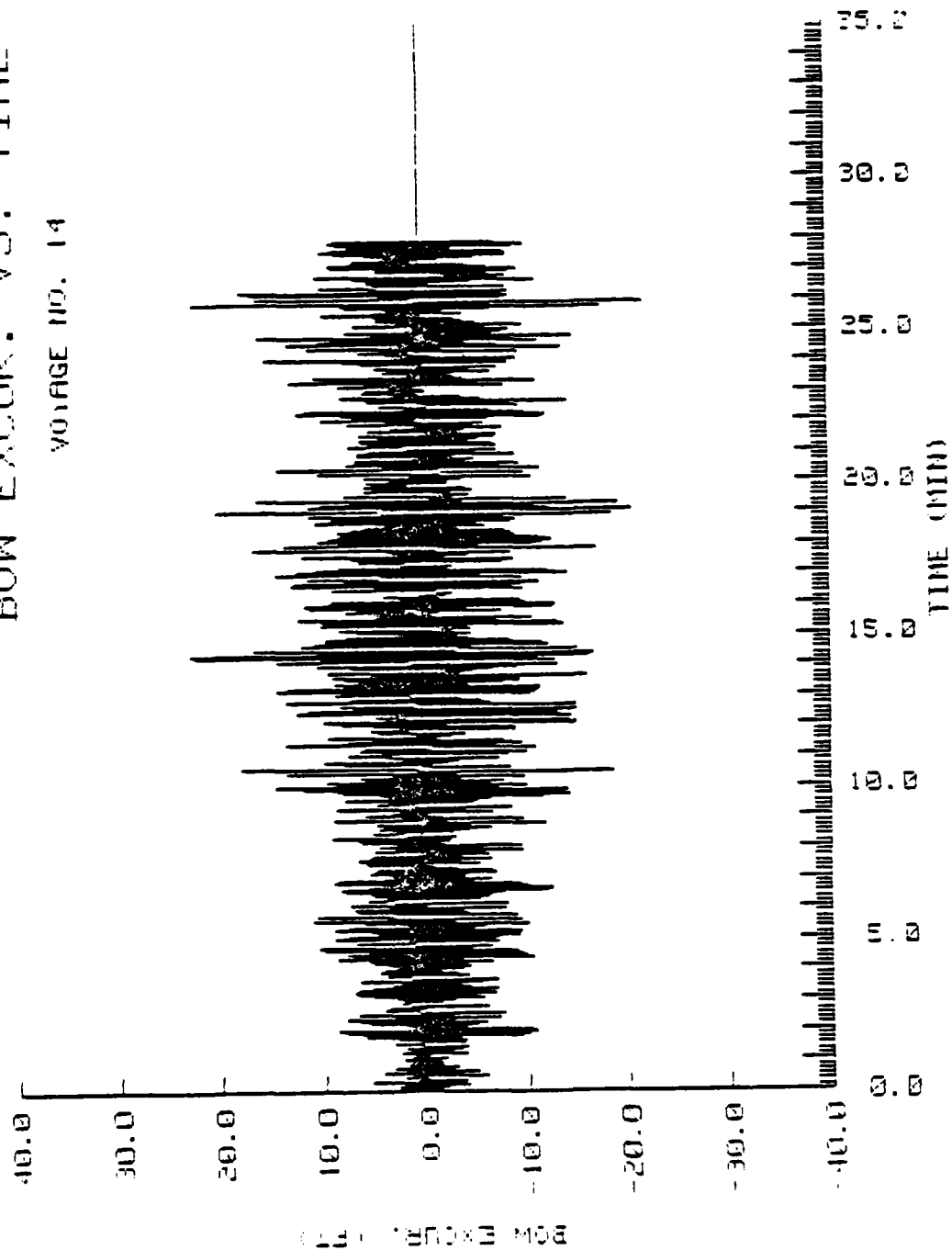
VORAGE NO. 14





# BOW EXCUR. VS. TIME

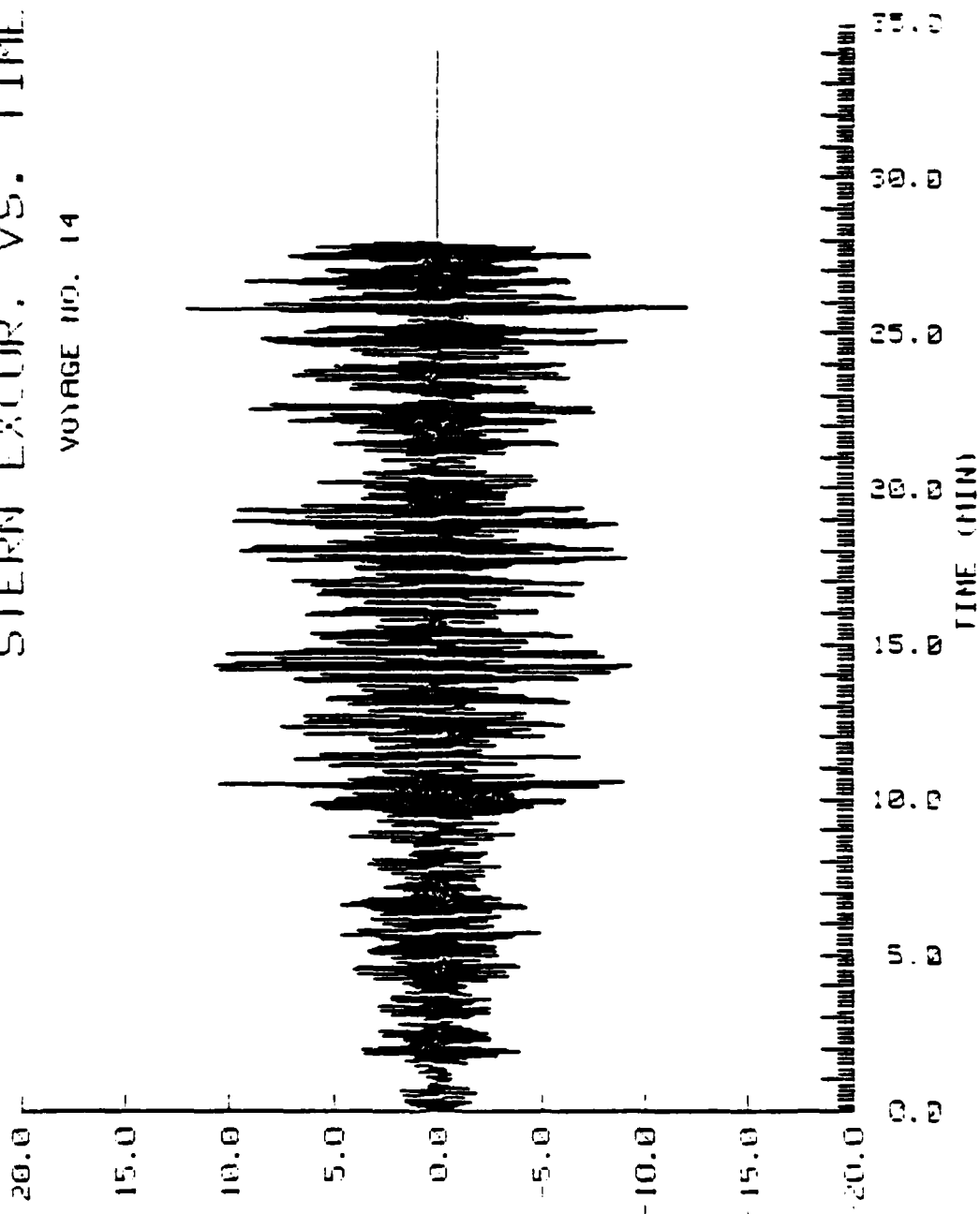
VOLAGE NO. 14





# STERN EXCUR. VS. TIME

VOYAGE NO. 14

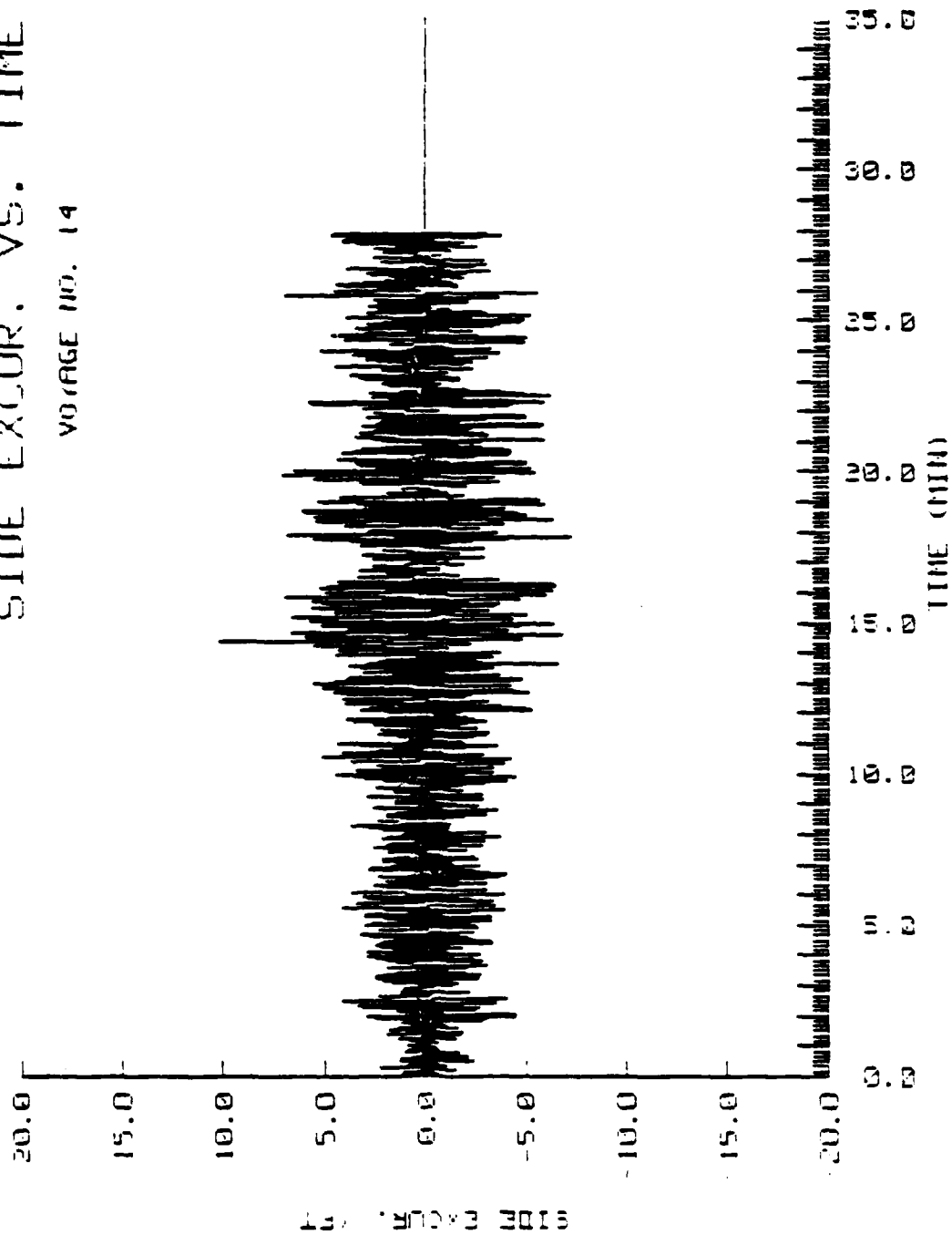


STERN EXCUR. (11)



# SIDE EXCUR. VS. TIME

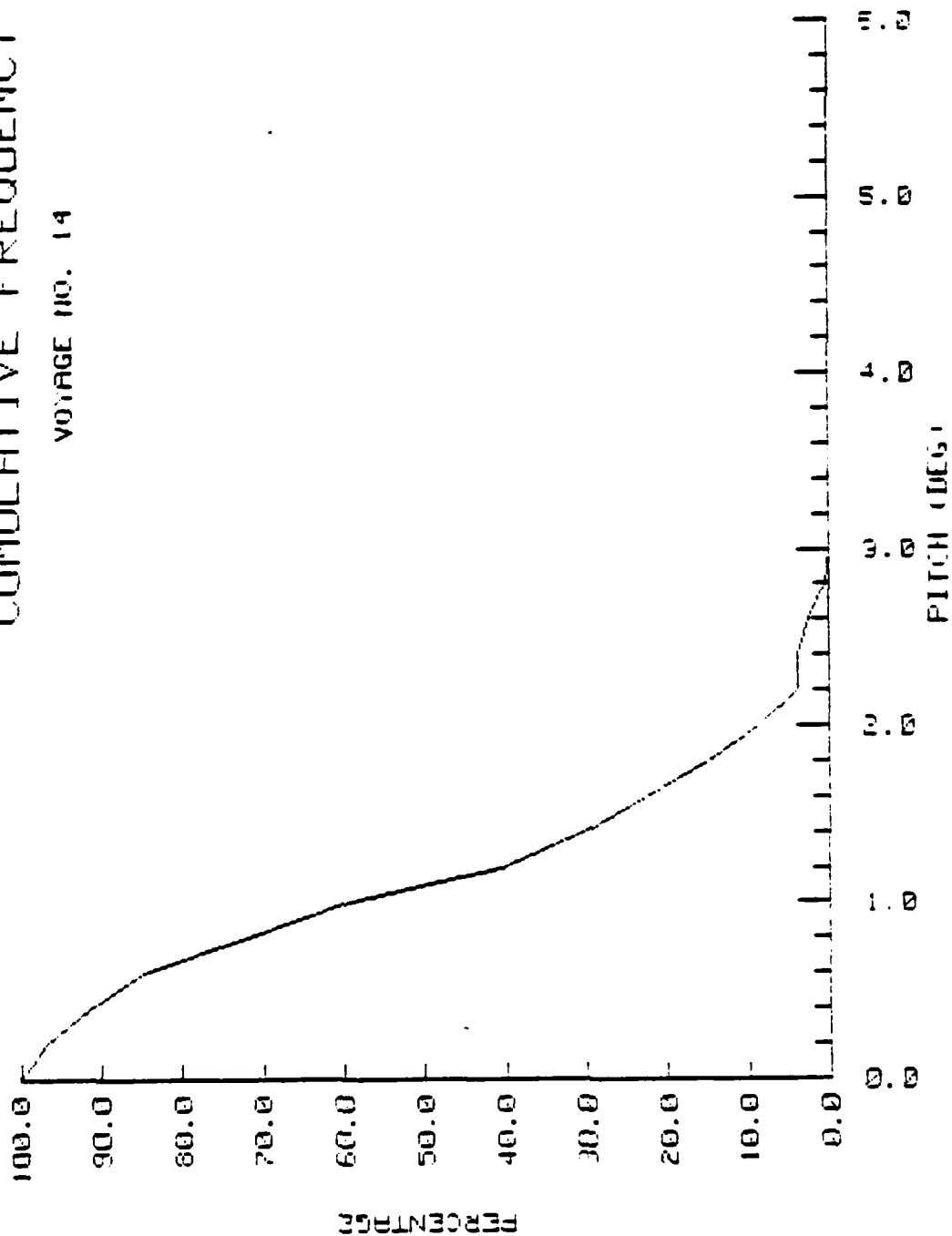
VORAGE NO. 14





# CUMULATIVE FREQUENCY

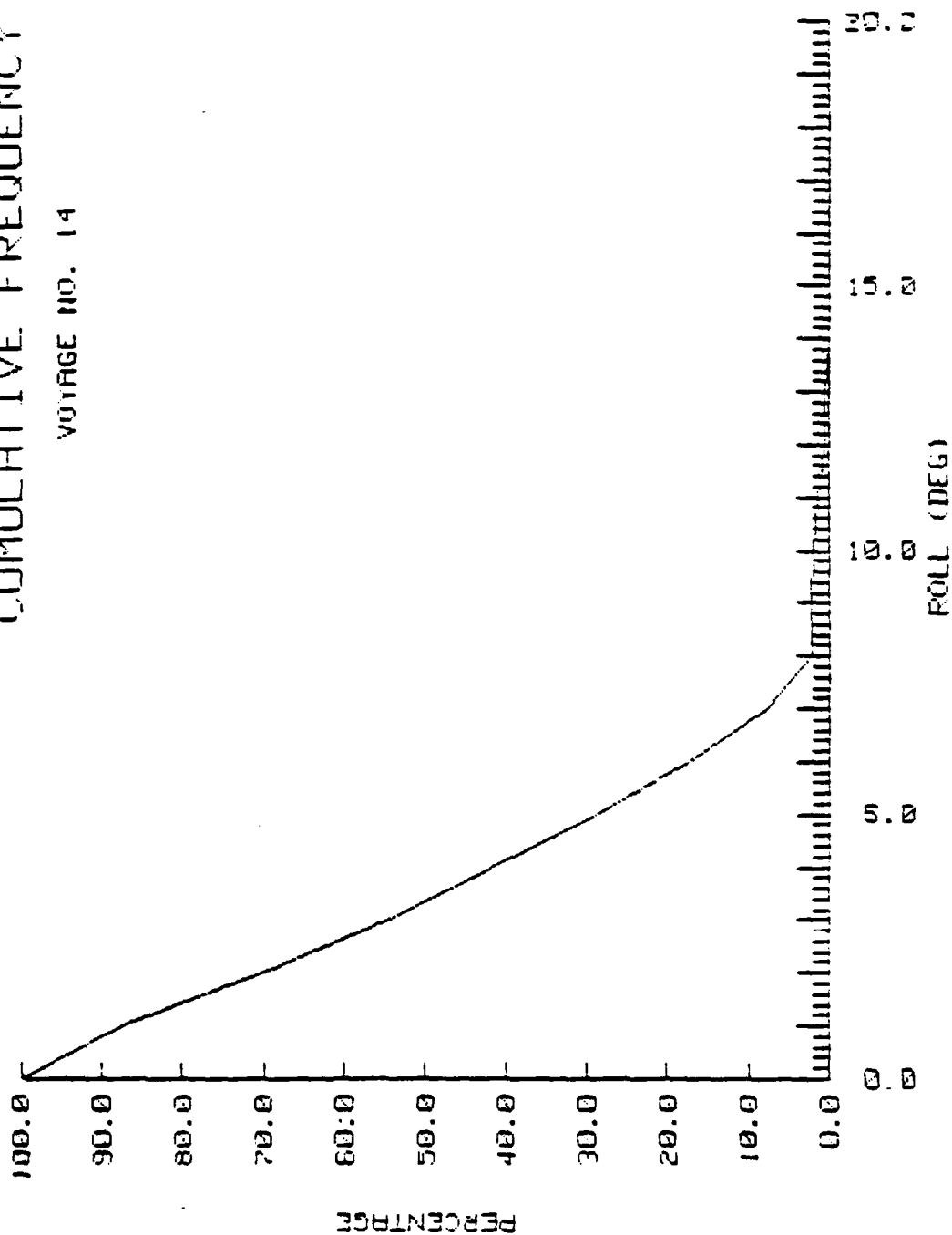
VOLTAGE NO. 14





# CUMULATIVE FREQUENCY

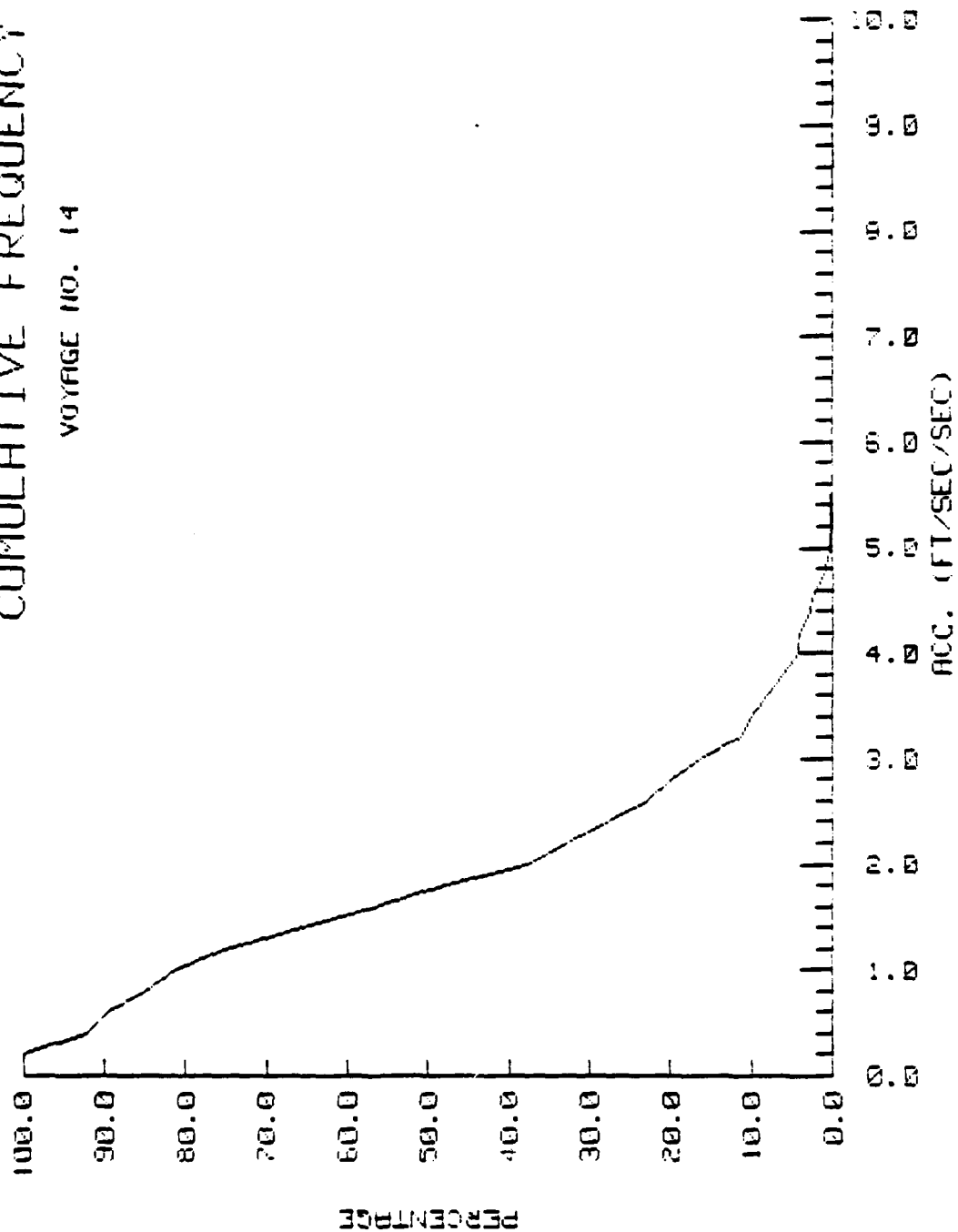
VOTAGE NO. 14





# CUMULATIVE FREQUENCY

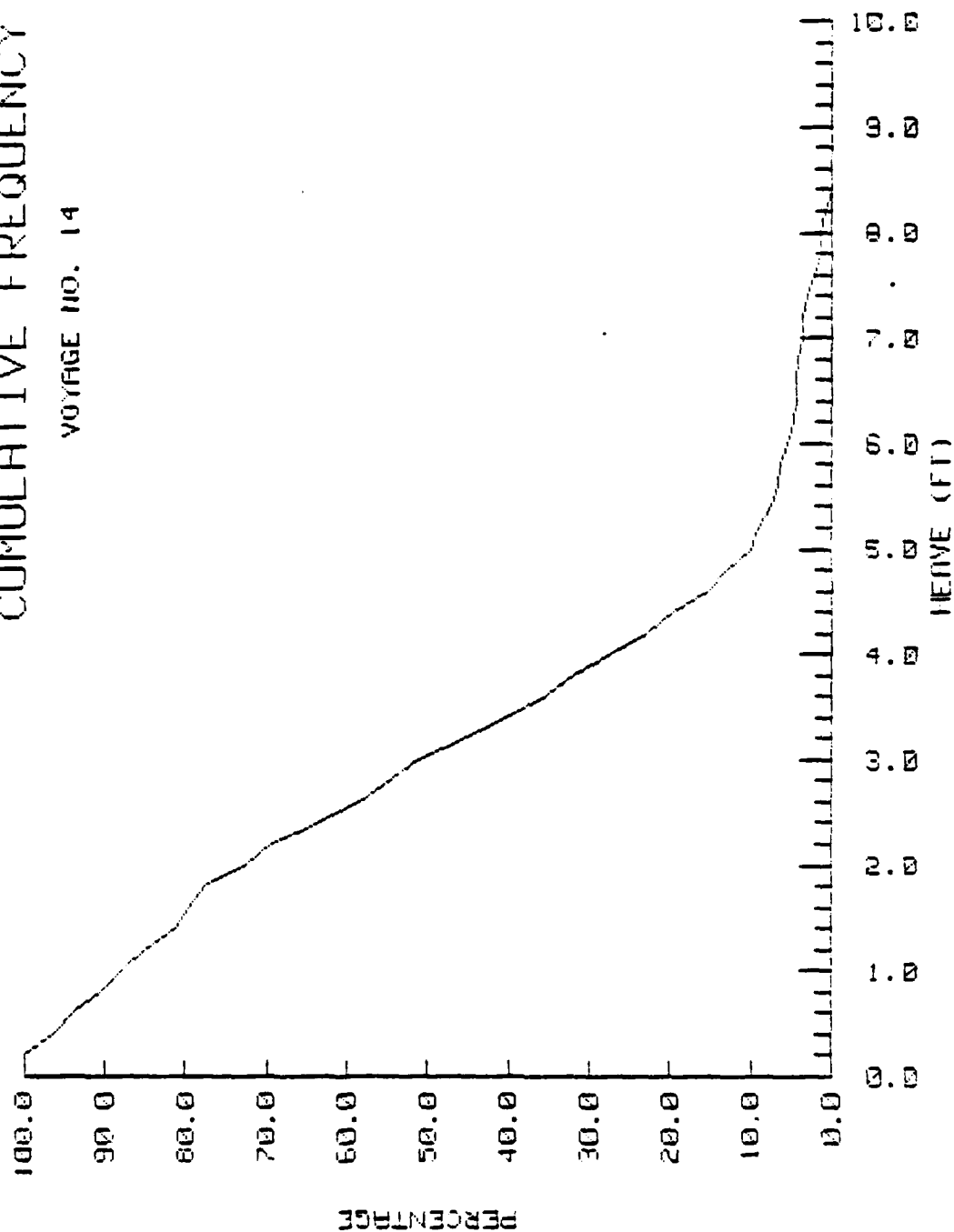
VOYAGE NO. 14





# CUMULATIVE FREQUENCY

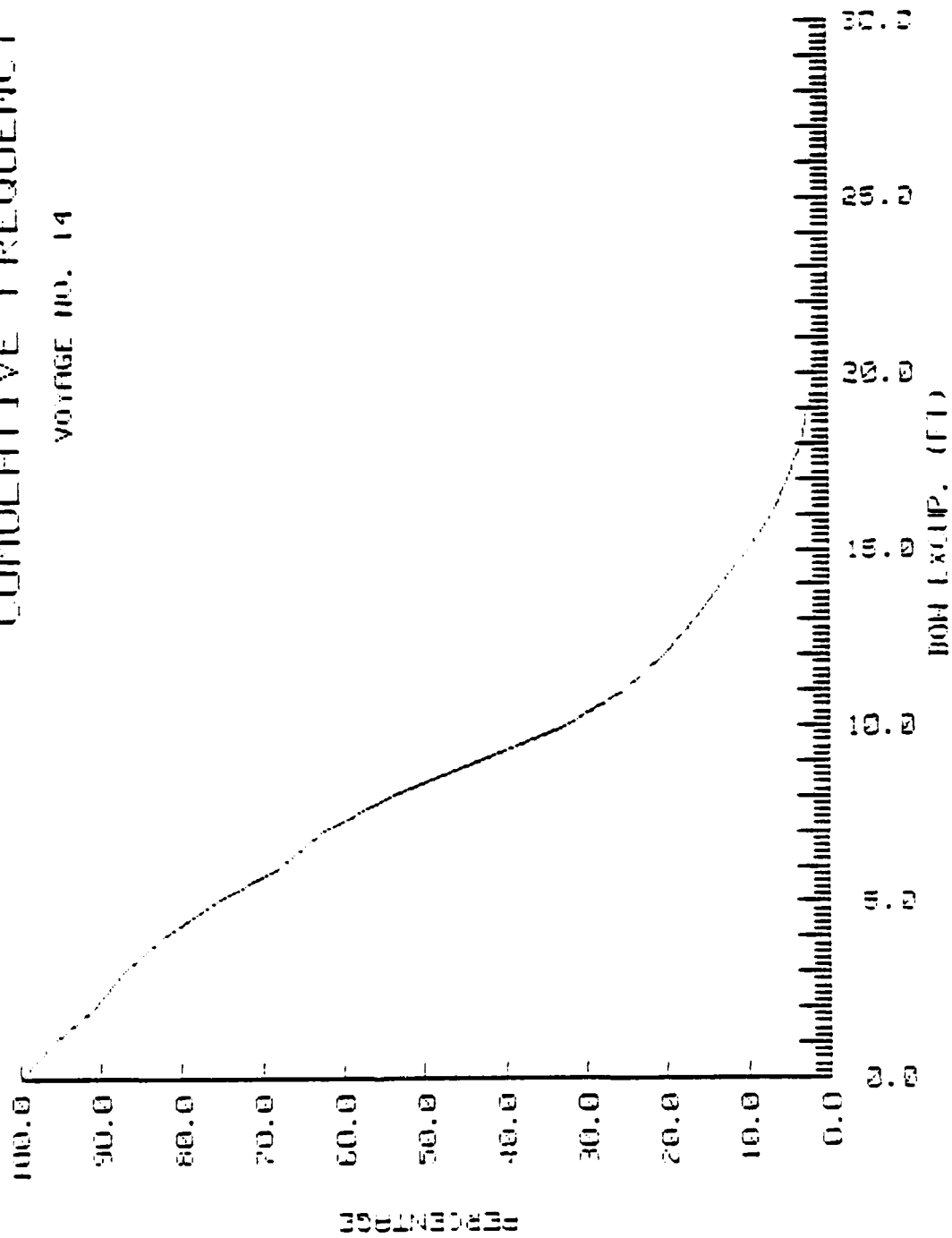
VOYAGE NO. 14





# CUMULATIVE FREQUENCY

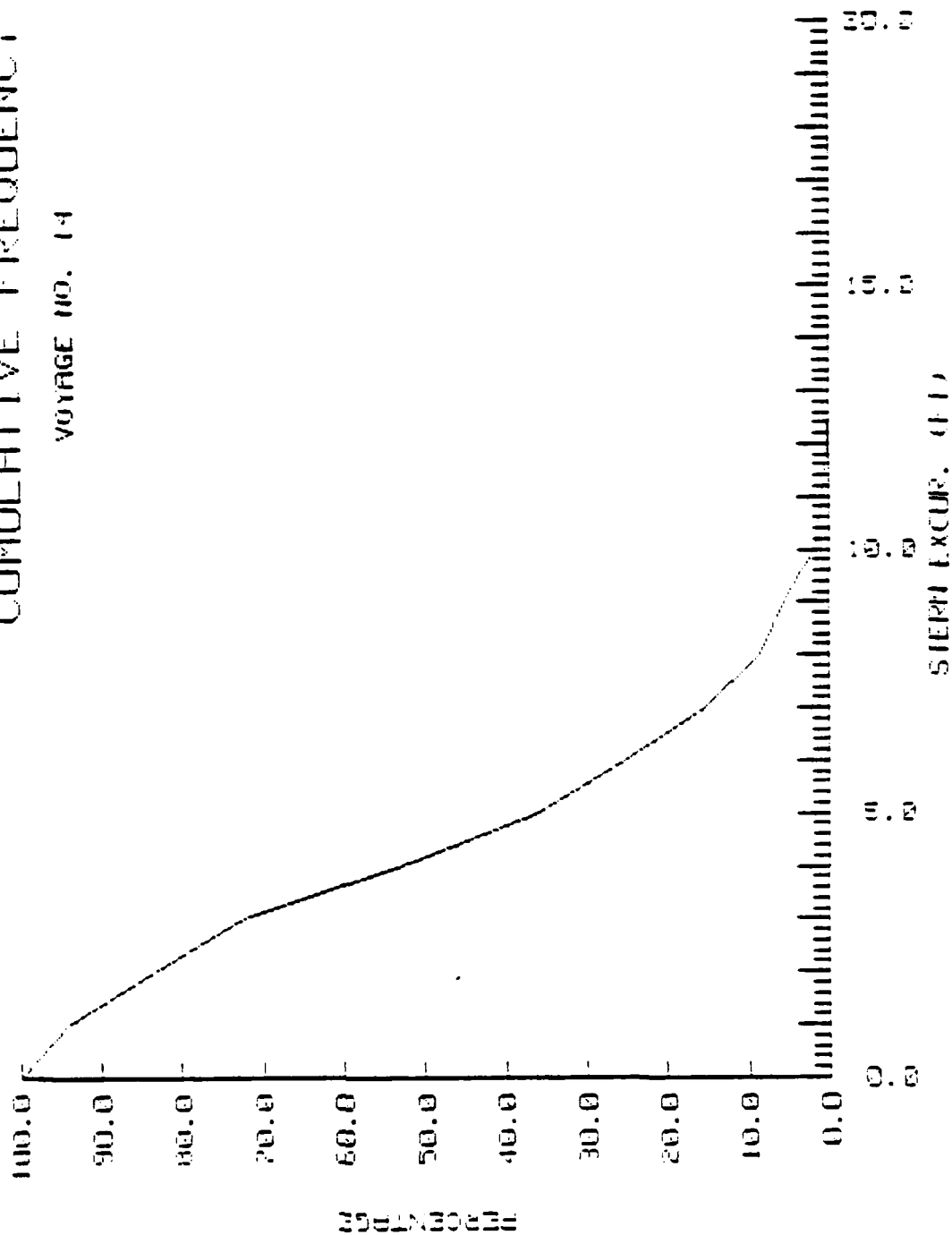
VOTAGE NO. 14





# CUMULATIVE FREQUENCY

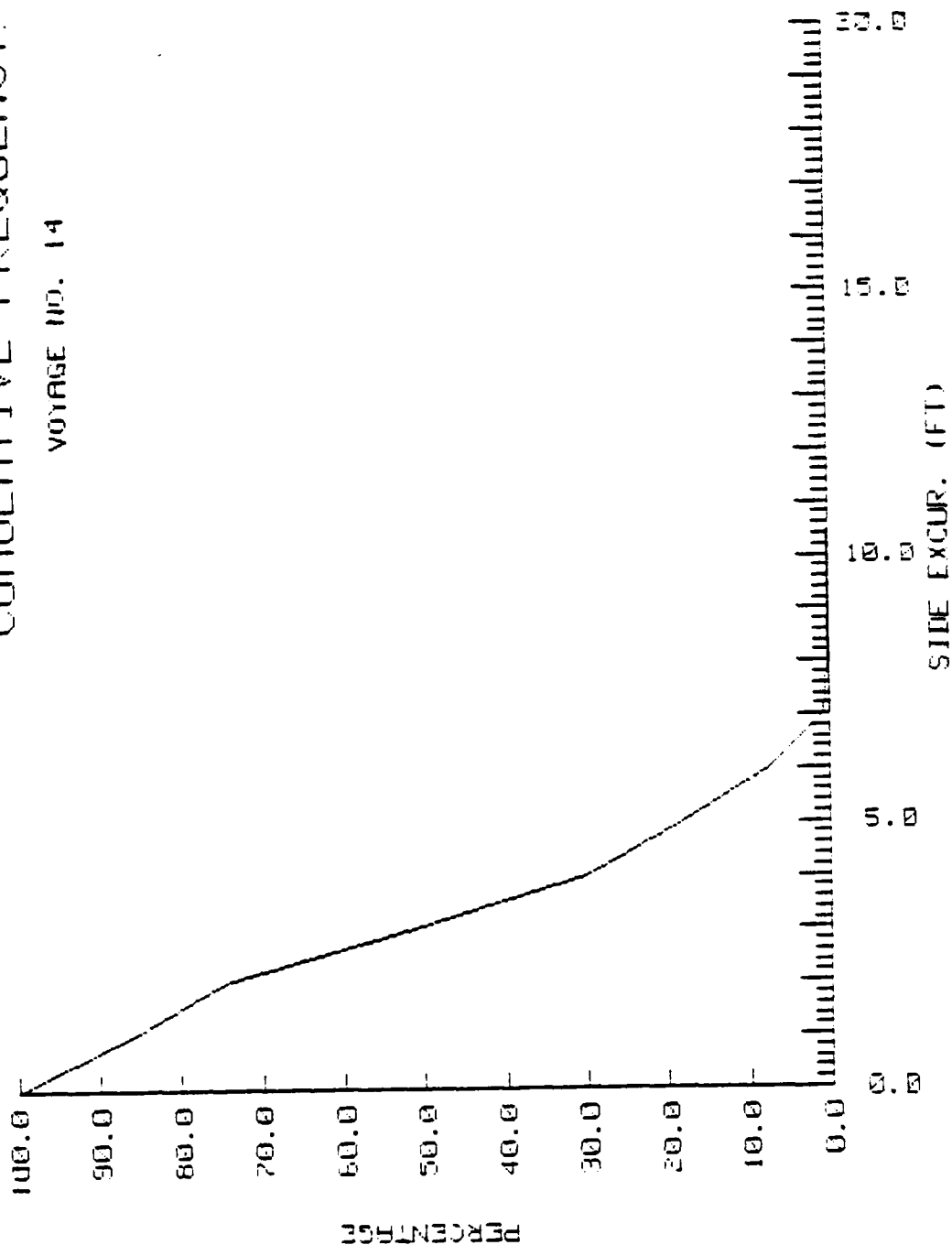
VOYAGE NO. 14





# CUMULATIVE FREQUENCY.

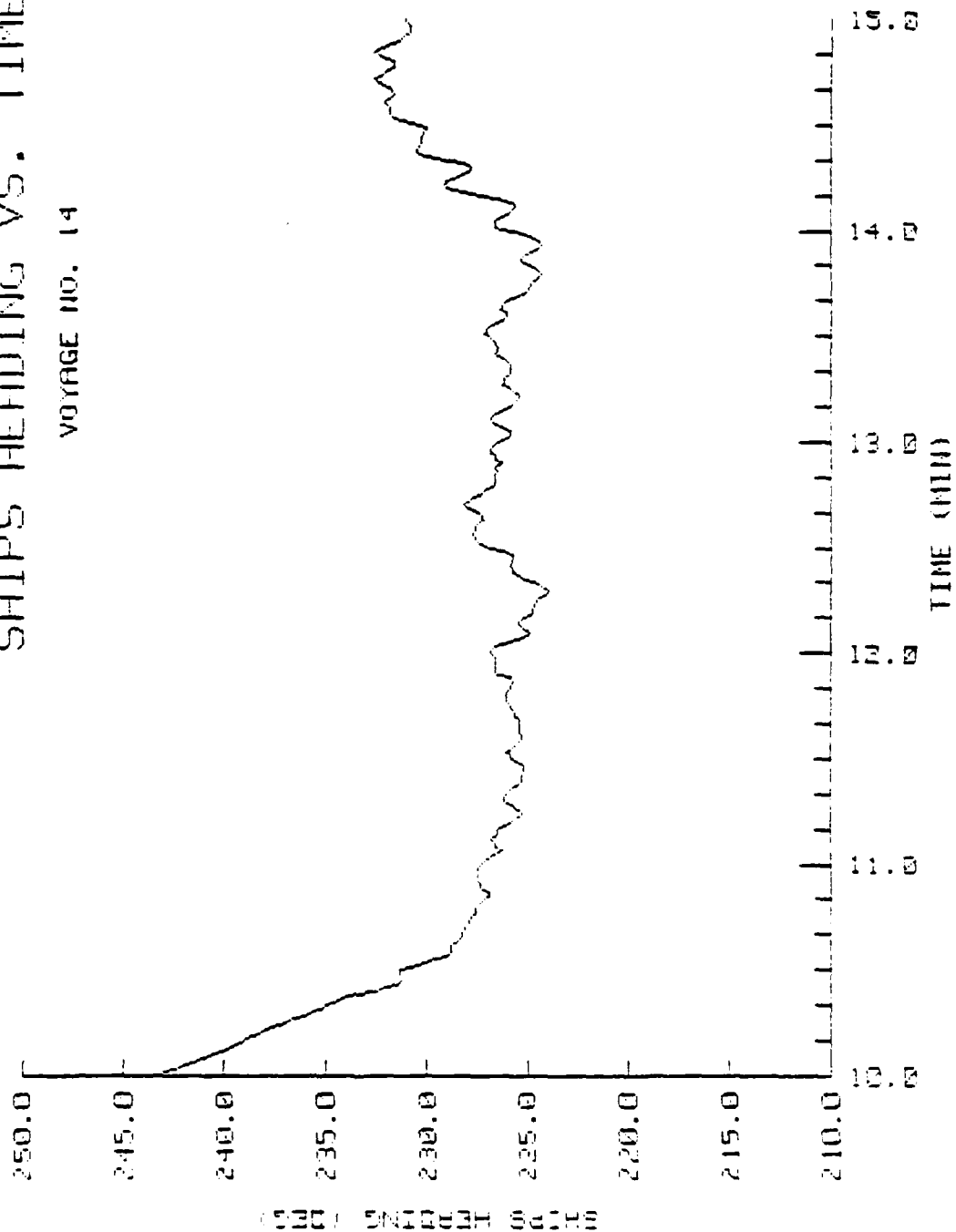
VOYAGE NO. 14





# SHIPS HEADING VS. TIME

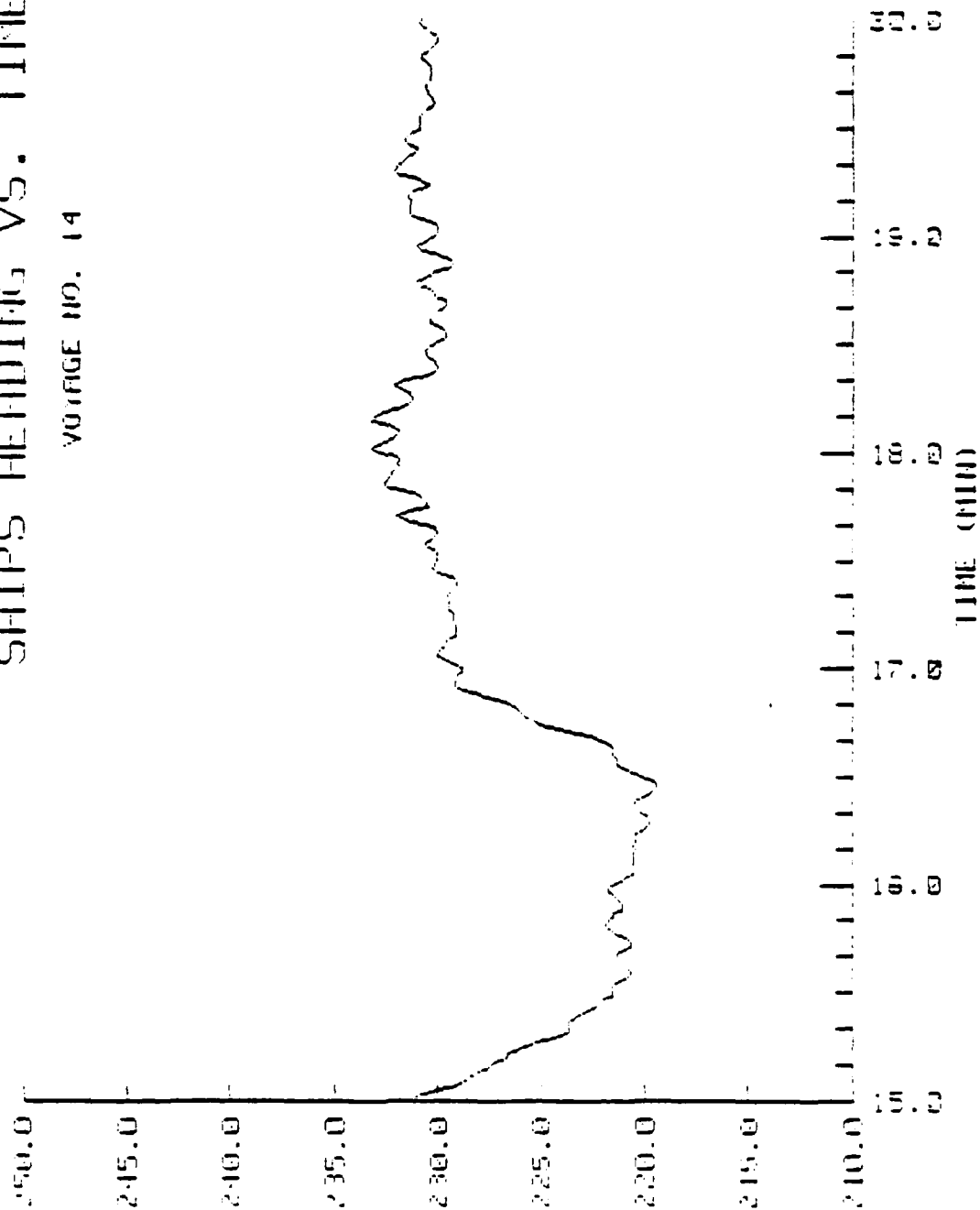
VOYAGE NO. 14





# SHIPS HEADING VS. TIME

VOYAGE NO. 14

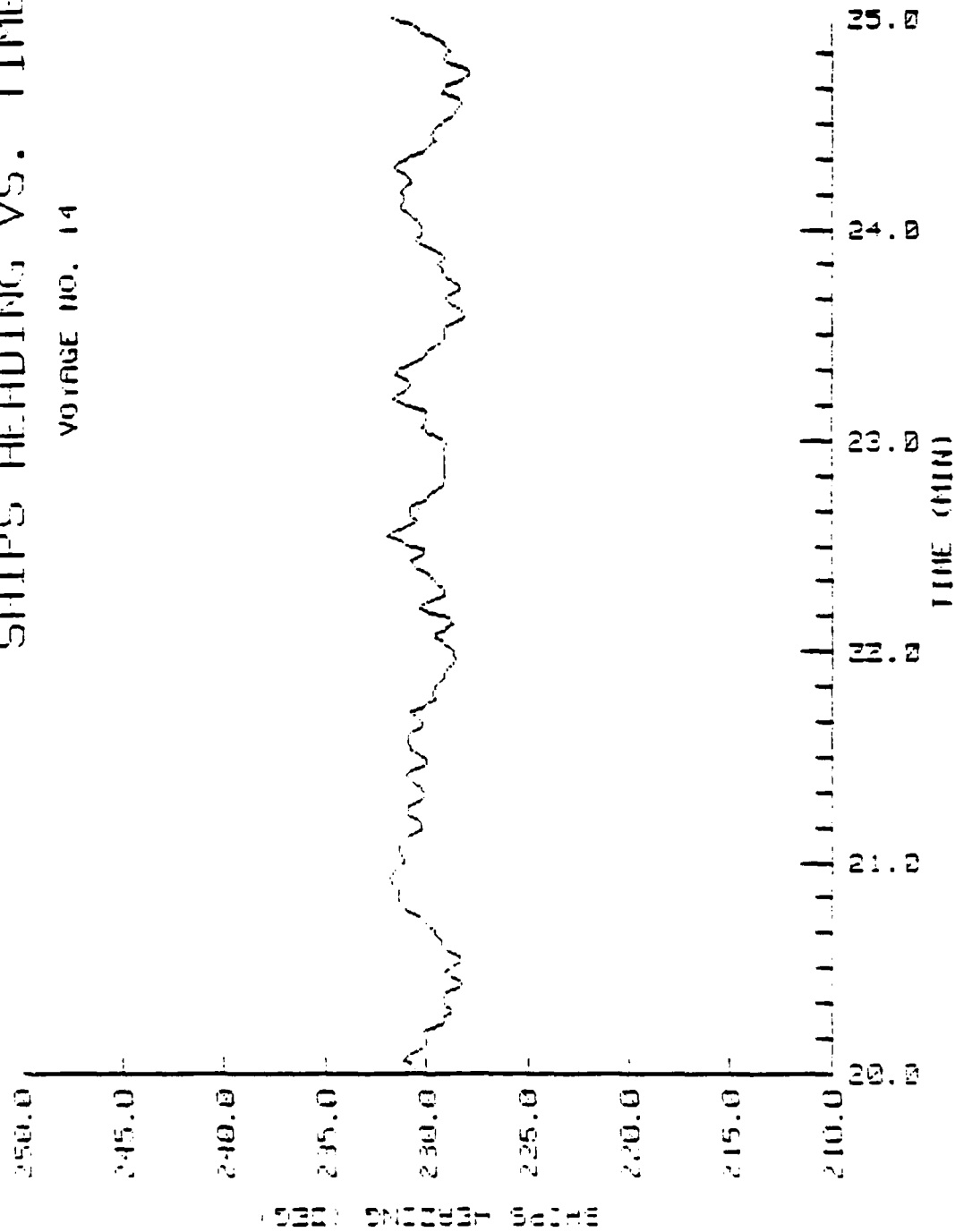


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# SHIPS HEADING VS. TIME

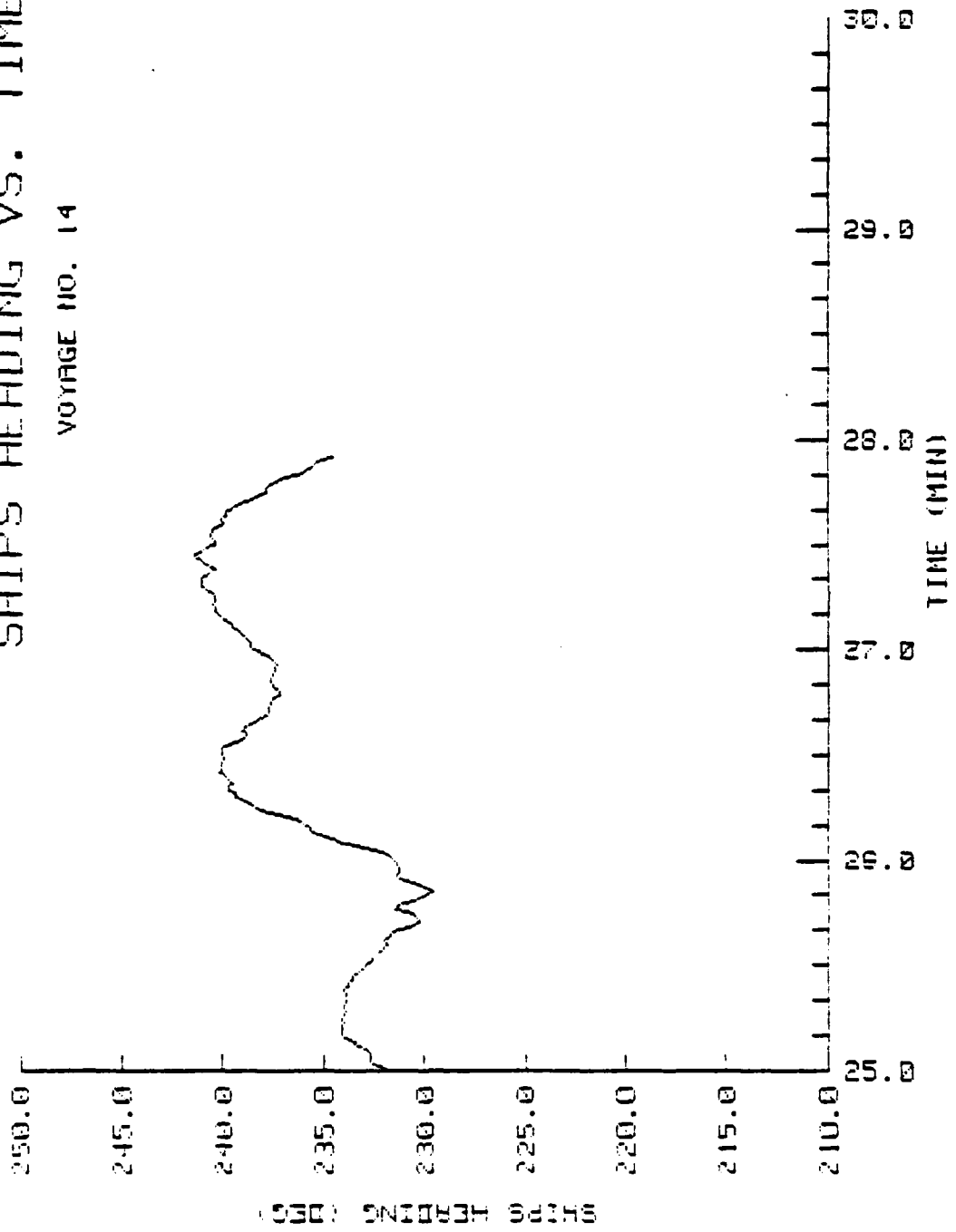
VOTAGE NO. 14





# SHIPS HEADING VS. TIME

VOYAGE NO. 14





# STATISTICAL SUMMARY

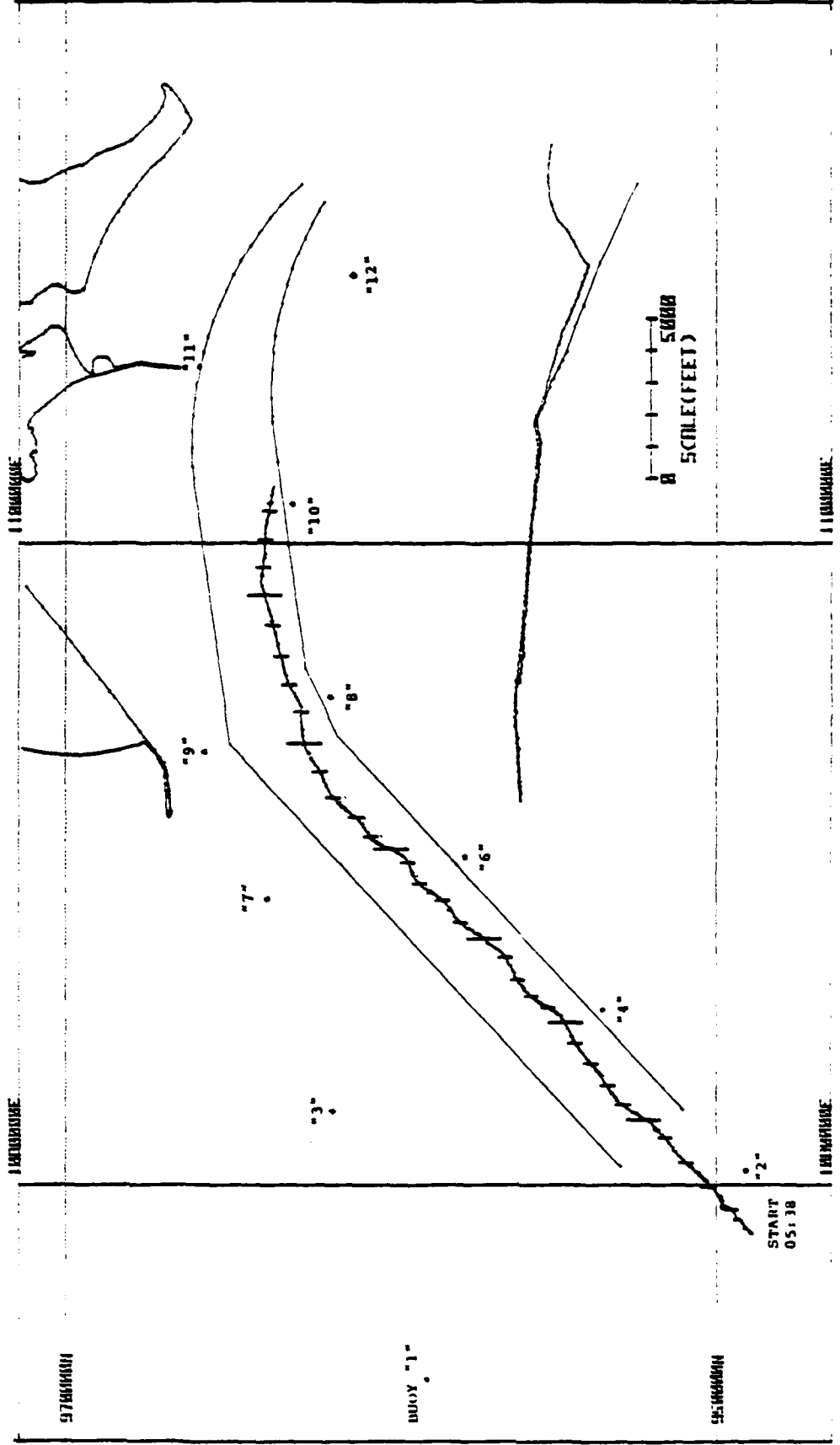
VOYAGE NO. 15

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.1	6.0	1.9	2.1
ROLL (DEG)	1.6	17.5	4.4	5.4
HEAVE (FT)	-0.0	3.7	1.2	1.3
WAVE (FT)	.1	9.7	2.7	3.2
BOW EXCUR. (FT)	.1	16.7	6.0	7.1
STERN EXCUR. (FT)	.1	32.6	9.8	11.6
SIDE EXCUR (FT)	.1	16.1	4.9	5.8



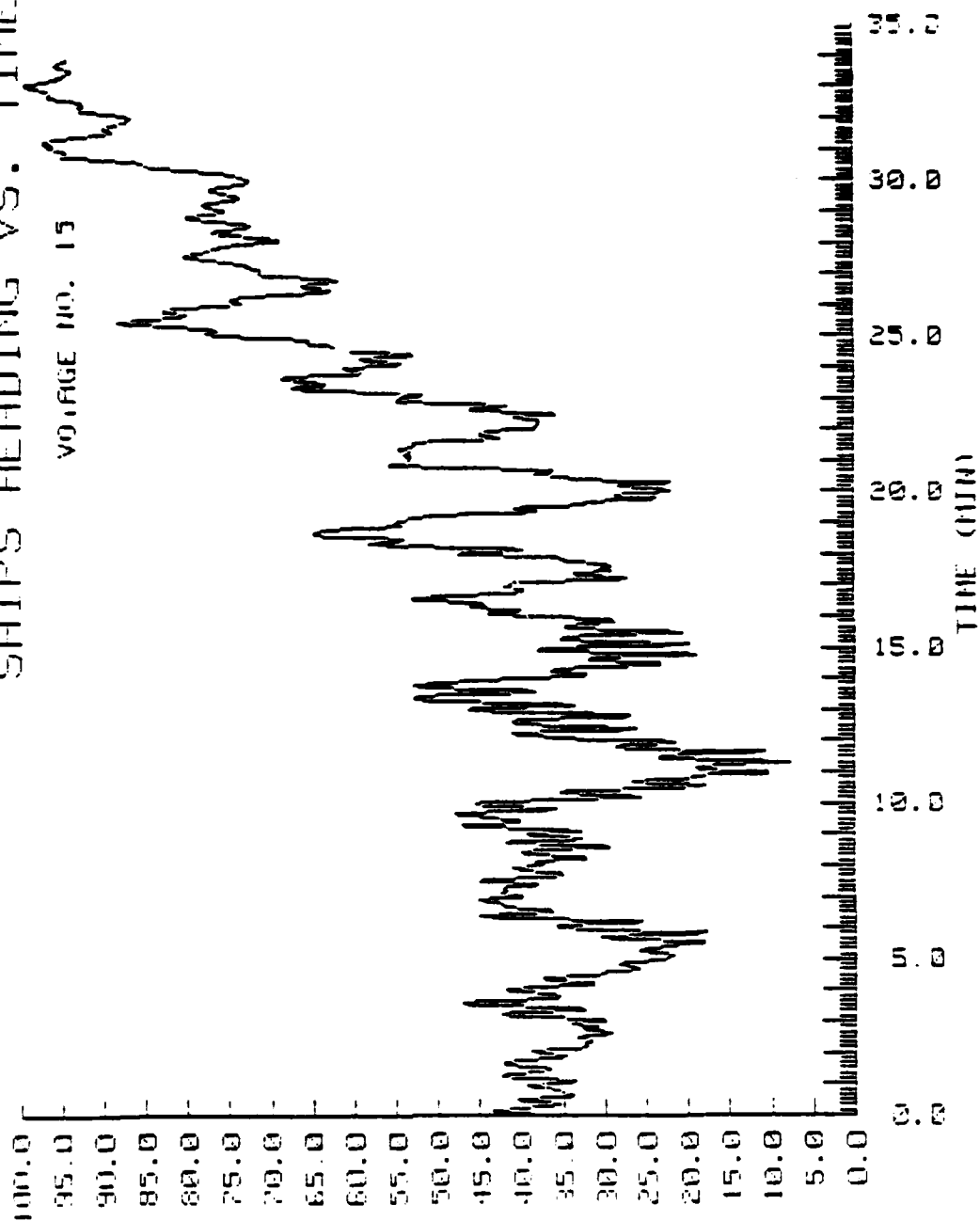
# VESSELS NO. 15 SHIP TRACK

SCALE: 1 INCH = 5 MILES





**VOLUME NO. 15**

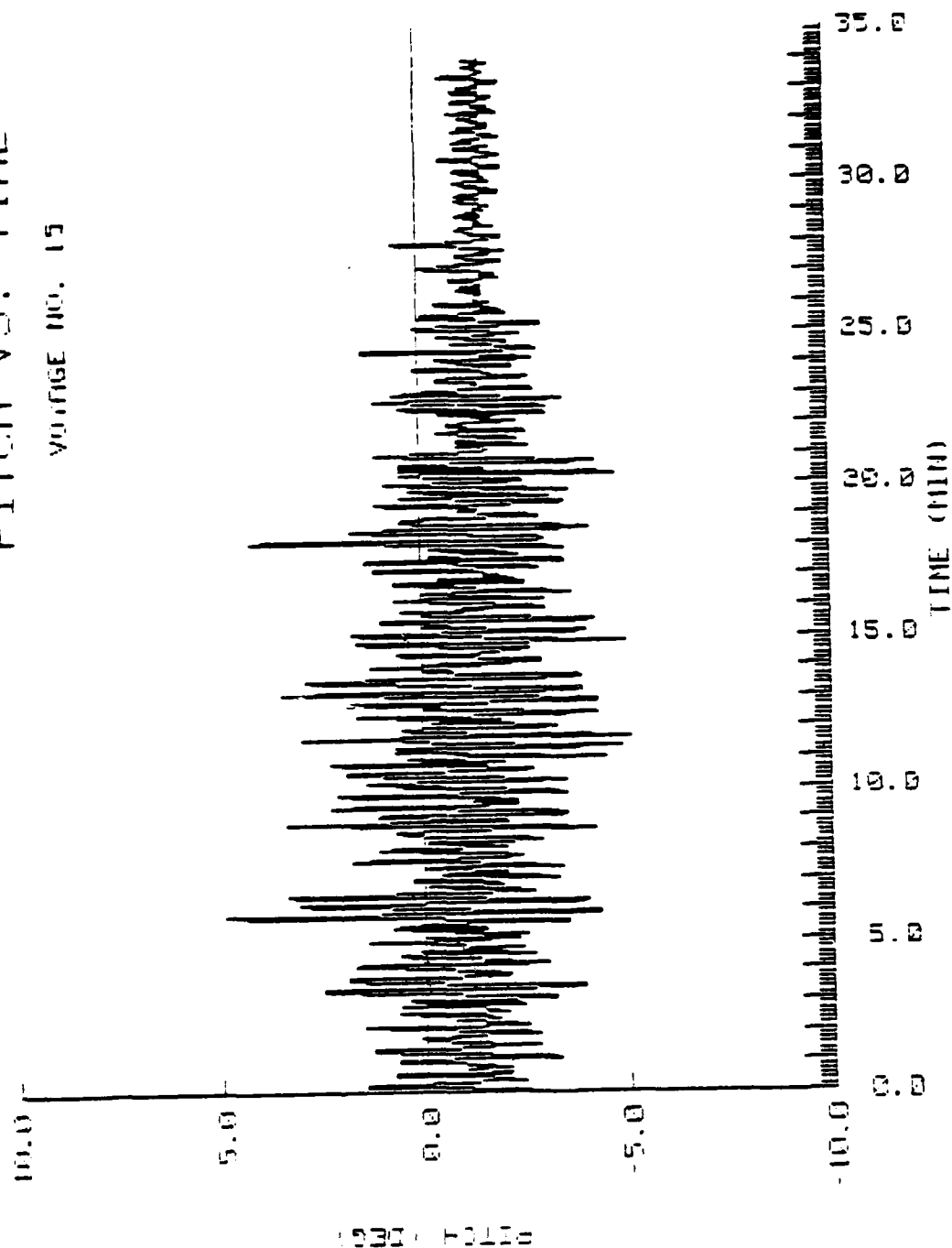


00000000000000000000



# PITCH VS. TIME

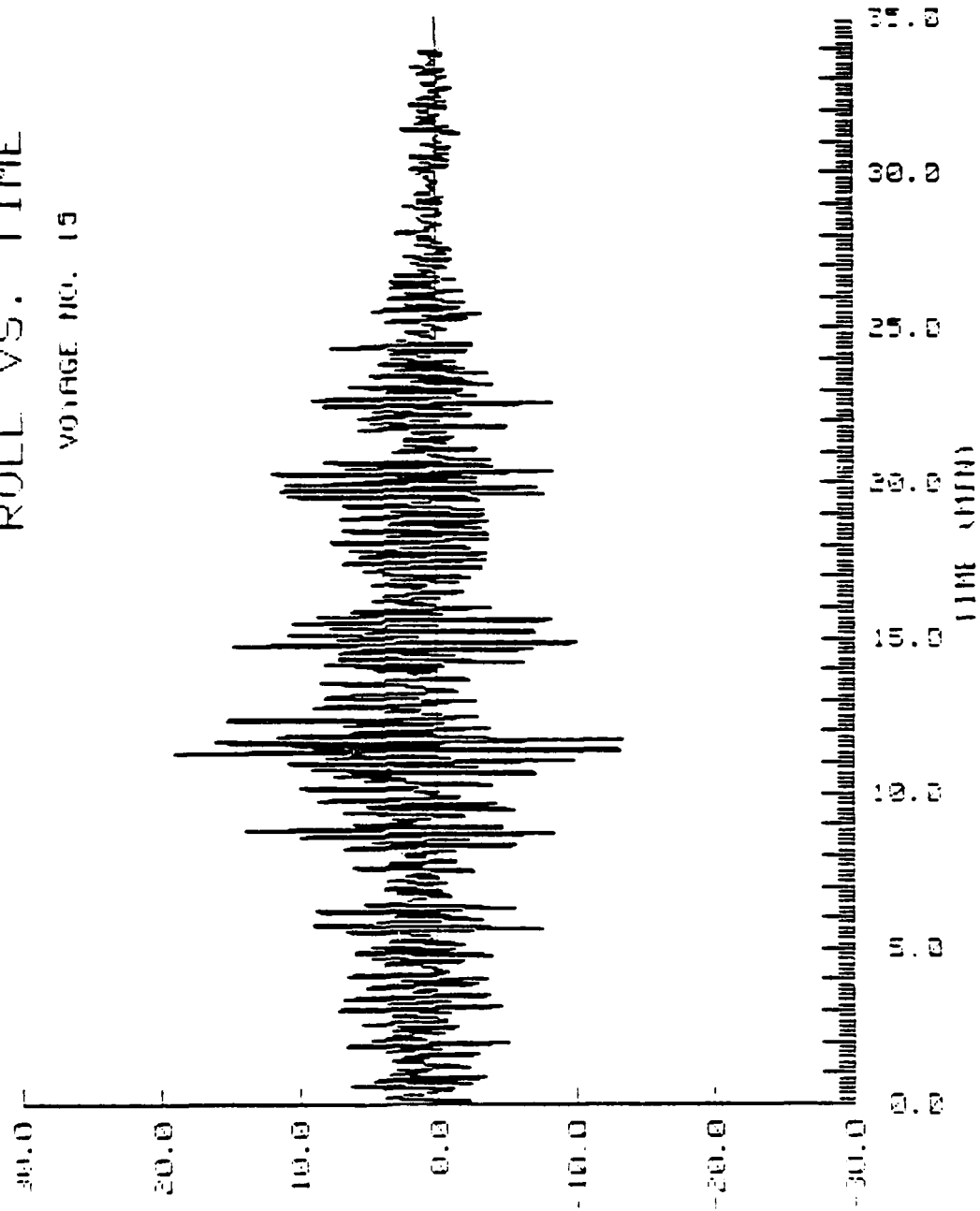
VOLUME NO. 15





# ROLL VS. TIME

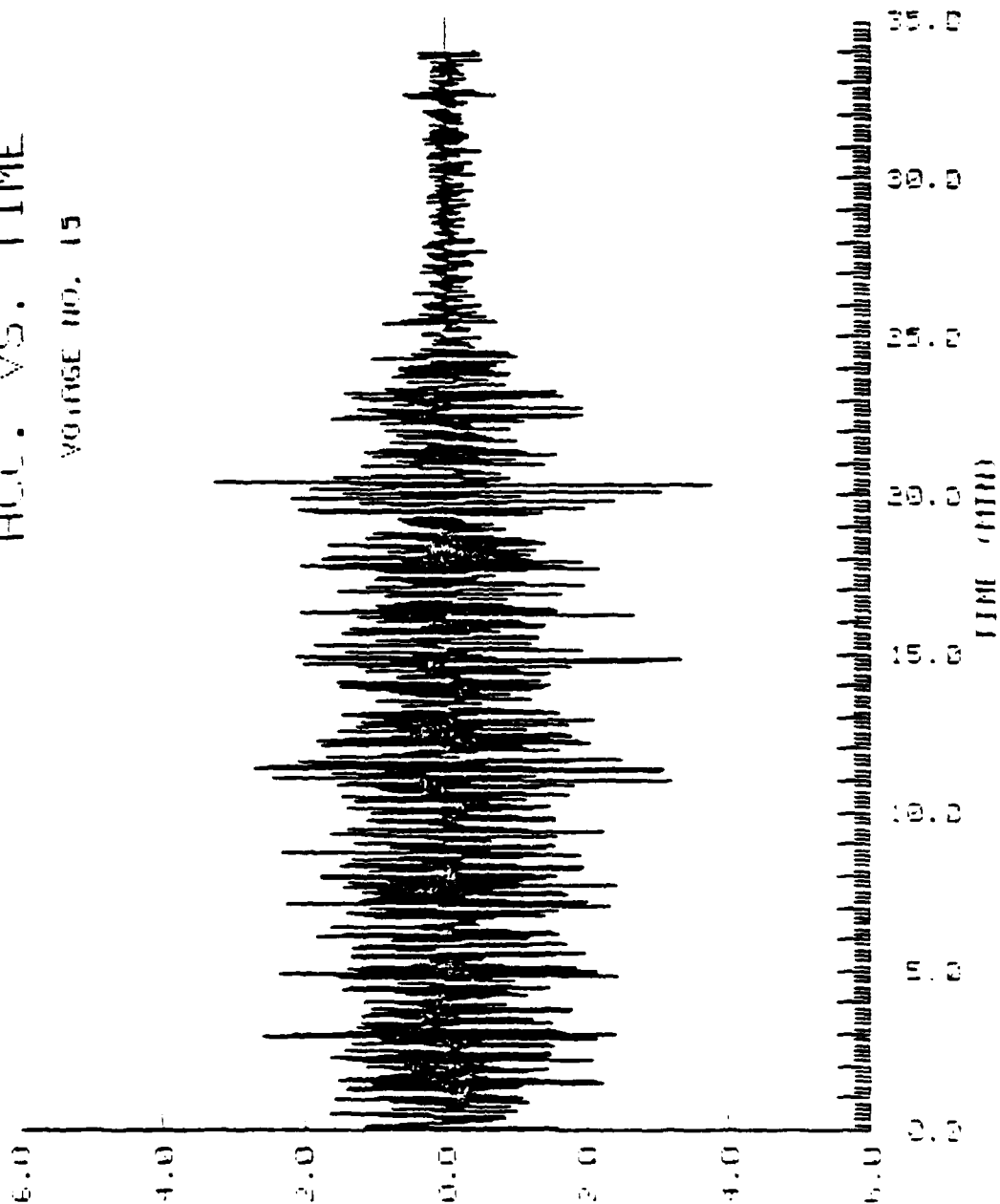
VORAGE NO. 15





ACC. VS. TIME

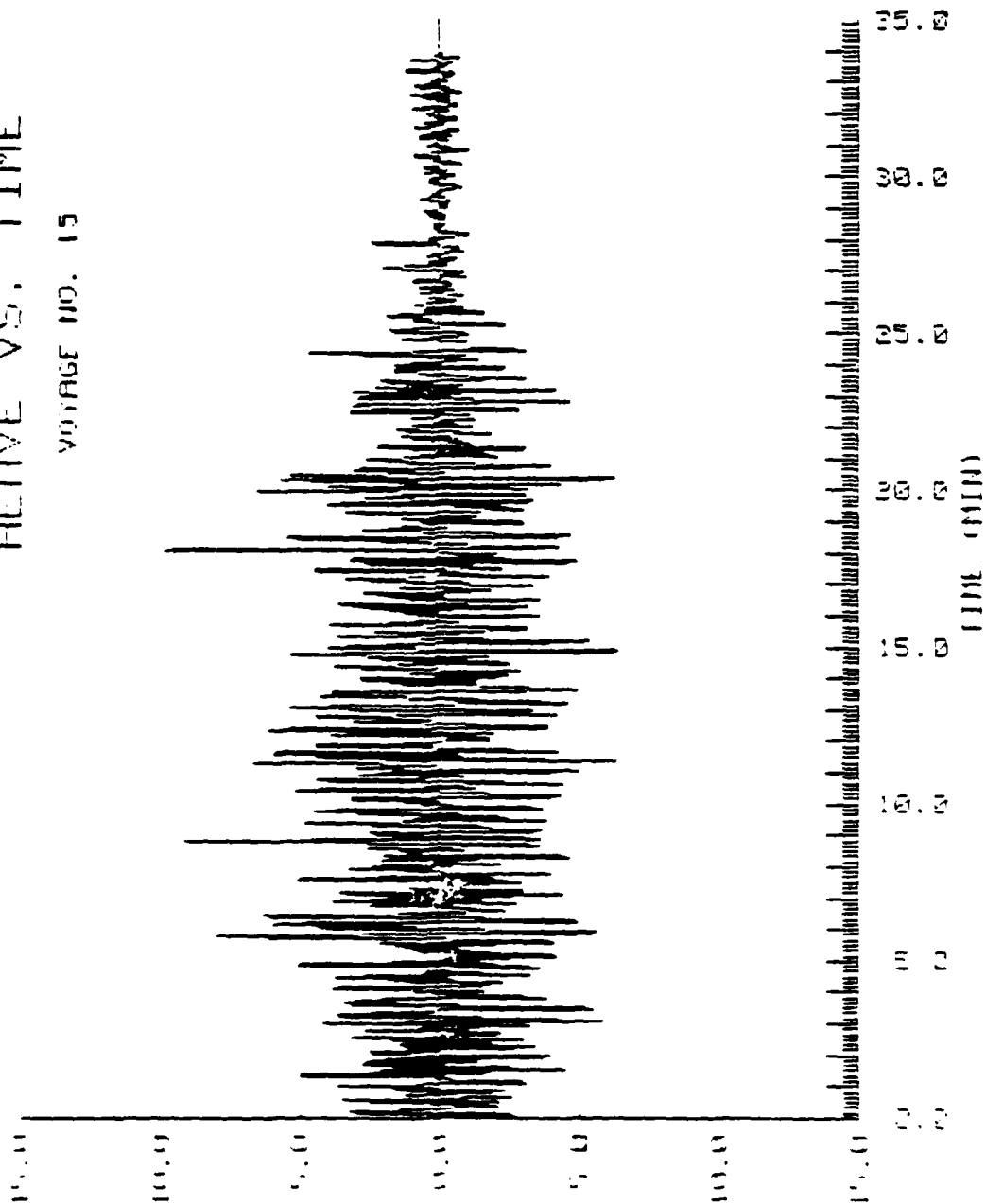
VOLUME NO. 15





# HEIIVE VS. TIME

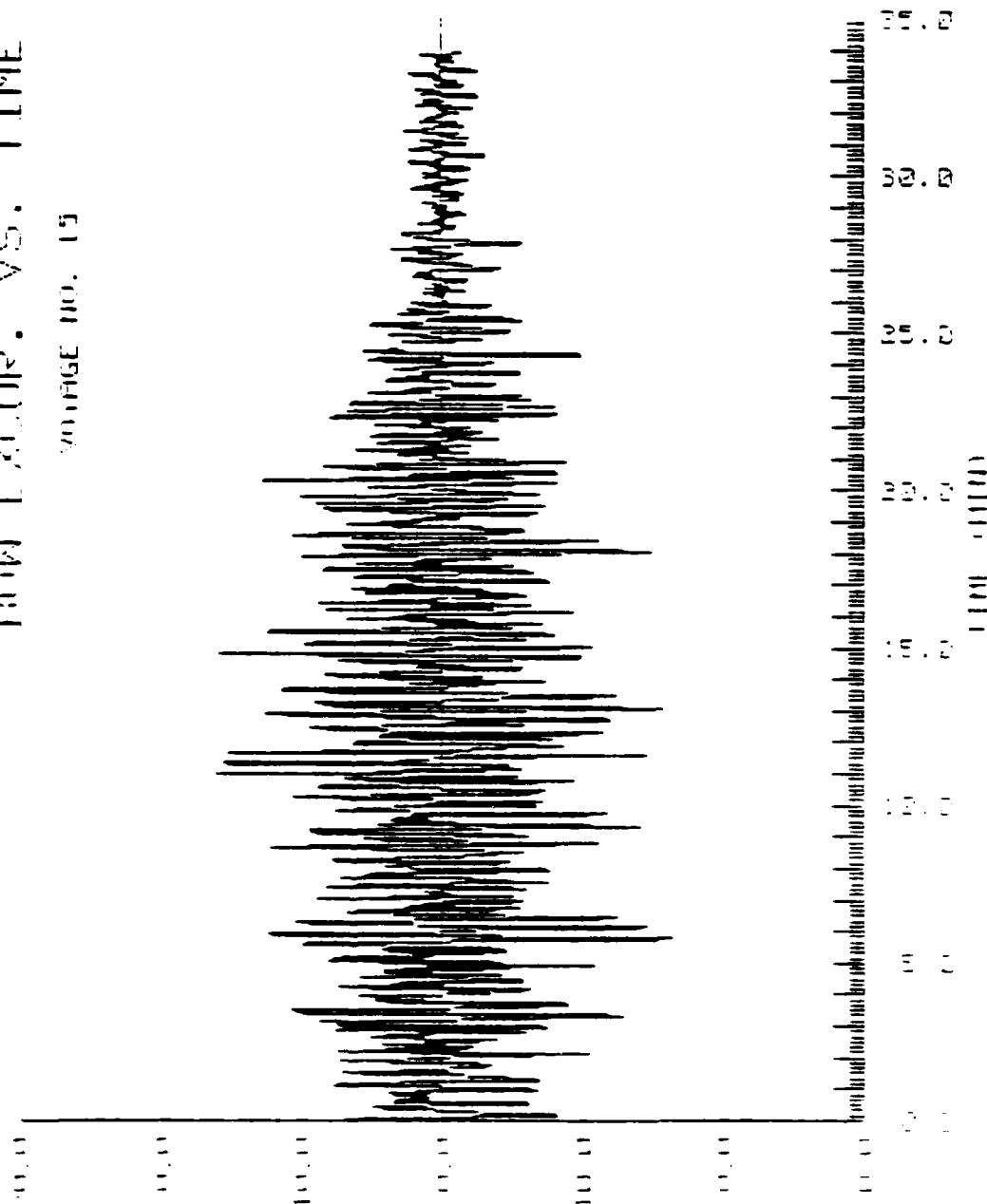
VOTAGE NO. 15





# RAW EXCUR. VS. TIME

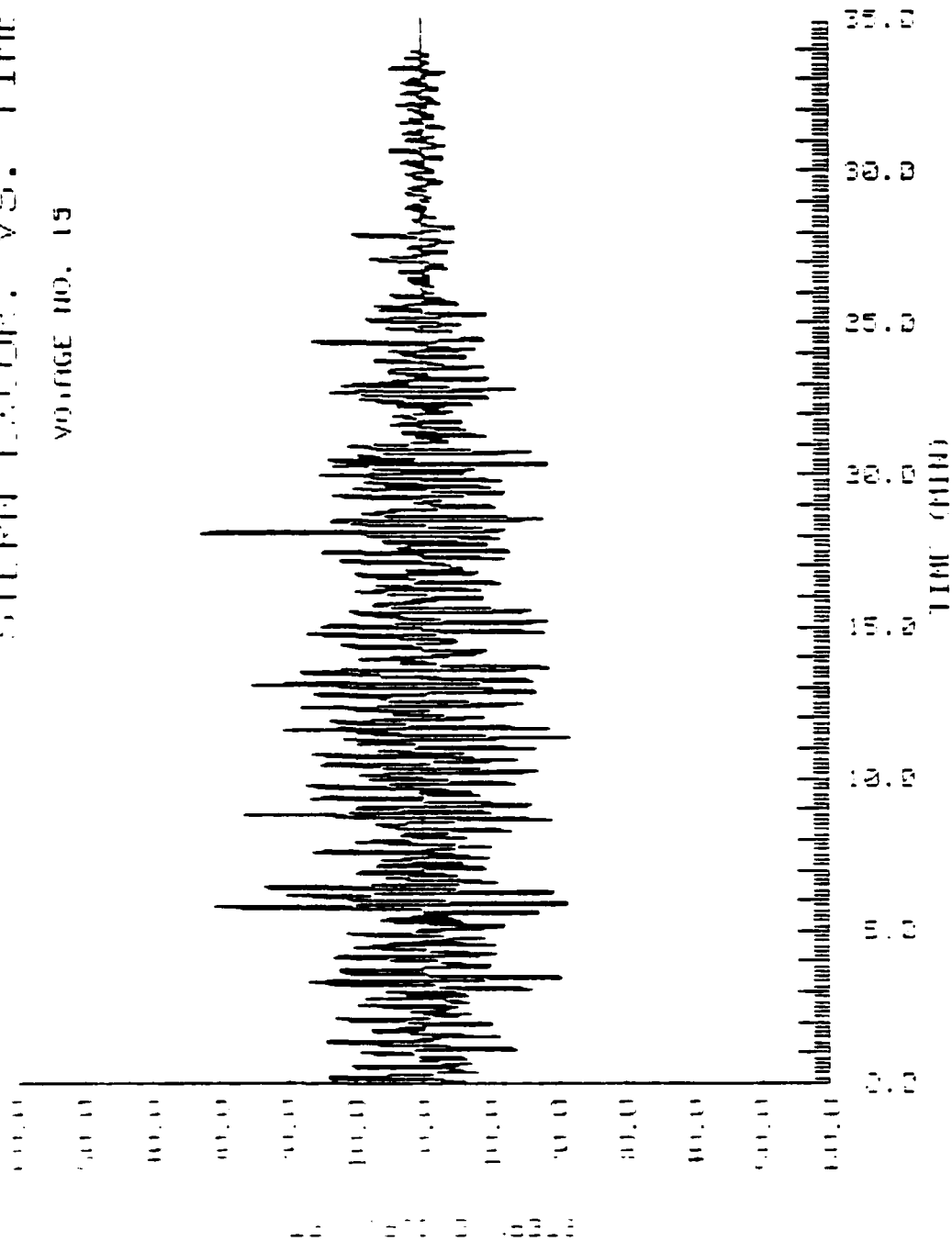
STATION NO. 15





SULPHUR VS. TIME

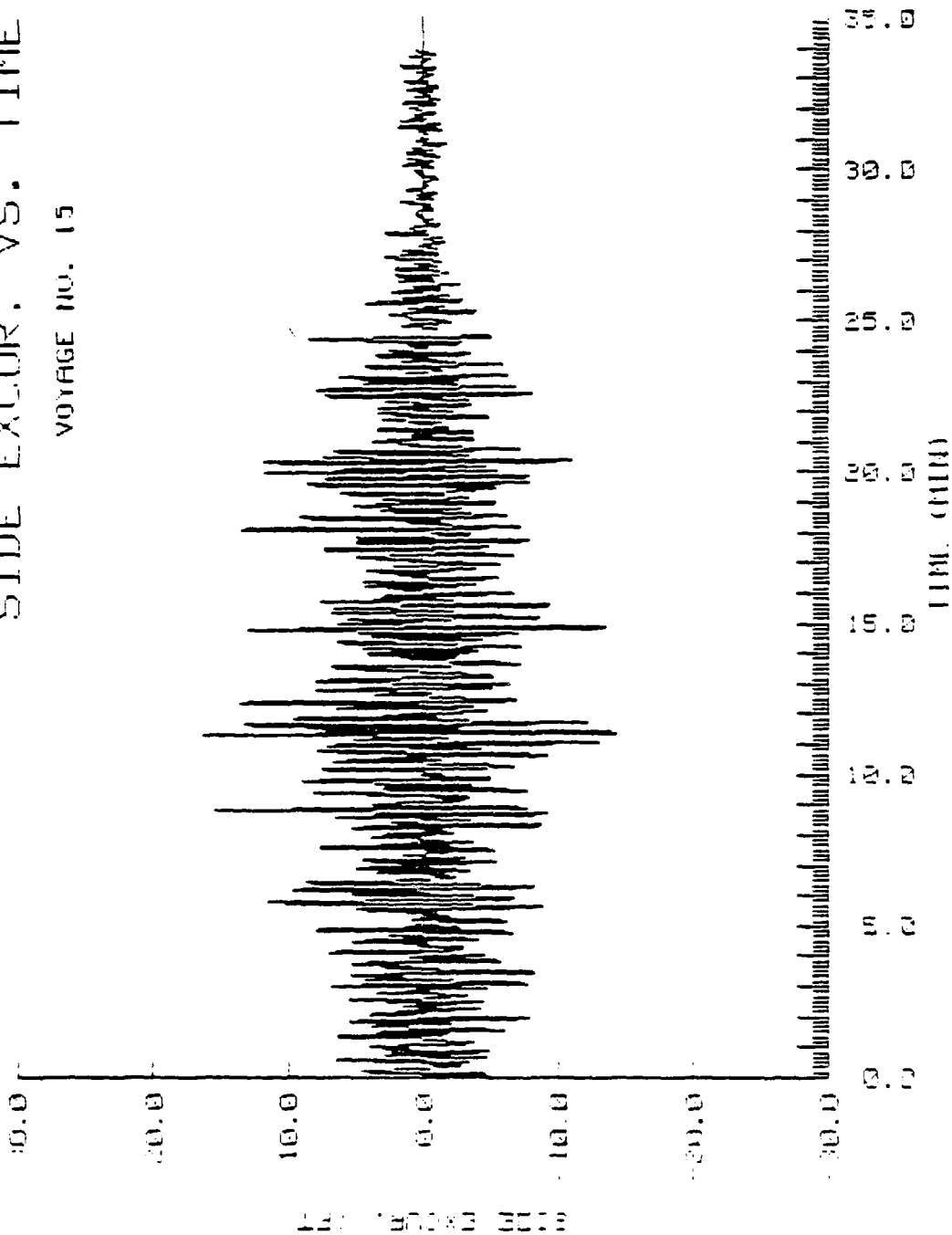
VOLUME NO. 15





# SIDE EXCUR. VS. TIME

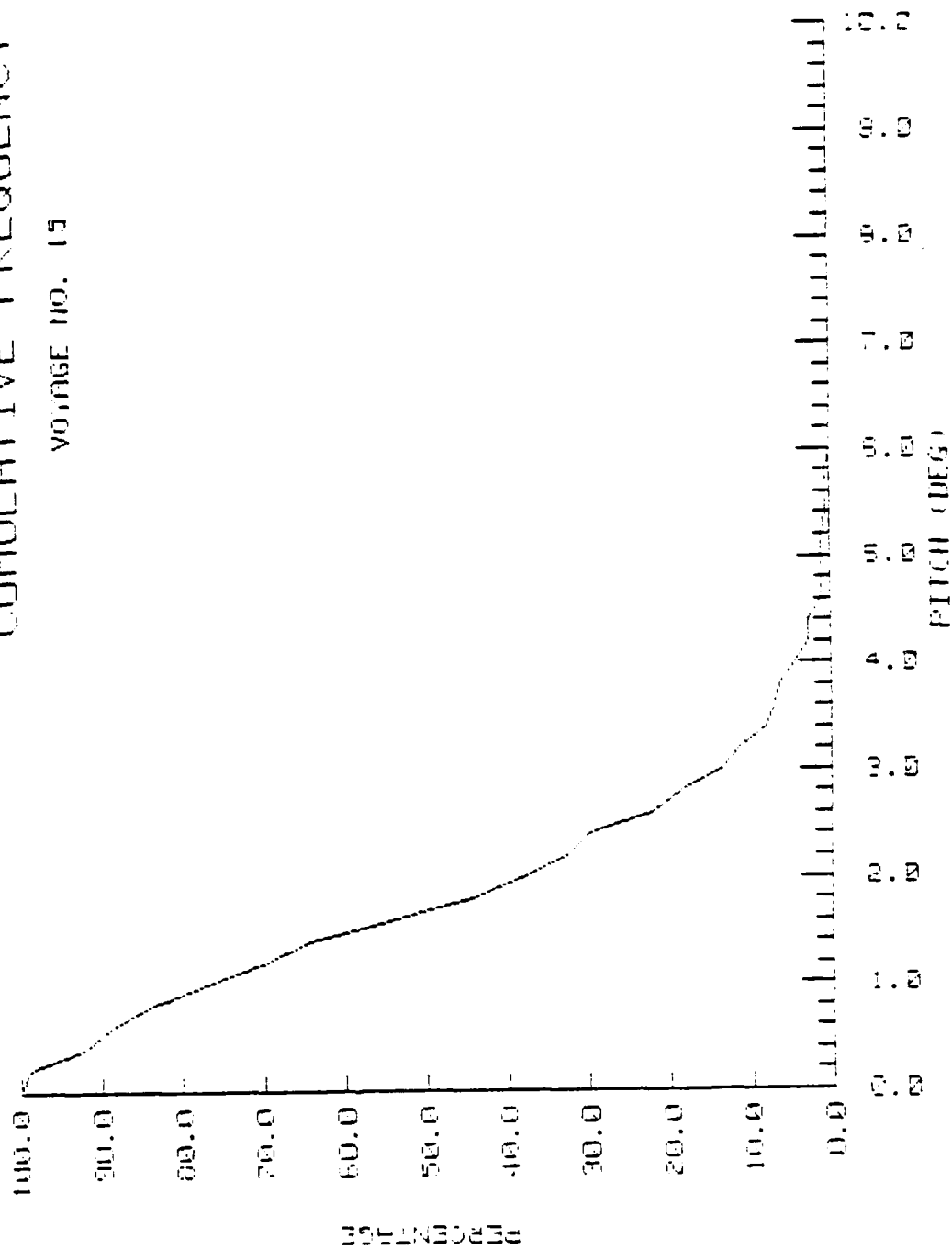
VOYAGE NO. 15





# CUMULATIVE FREQUENCY

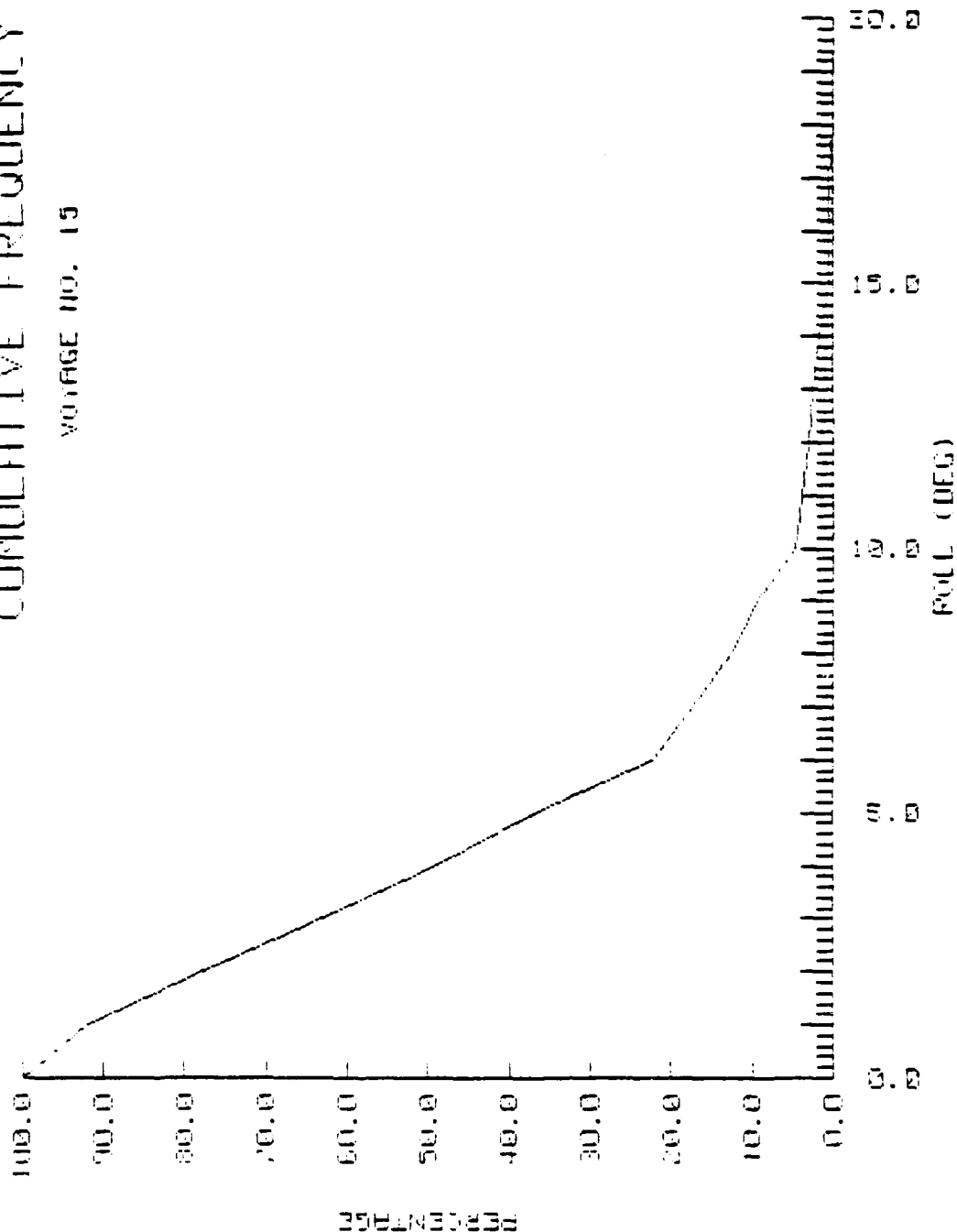
VOLUME NO. 15





# CUMULATIVE FREQUENCY

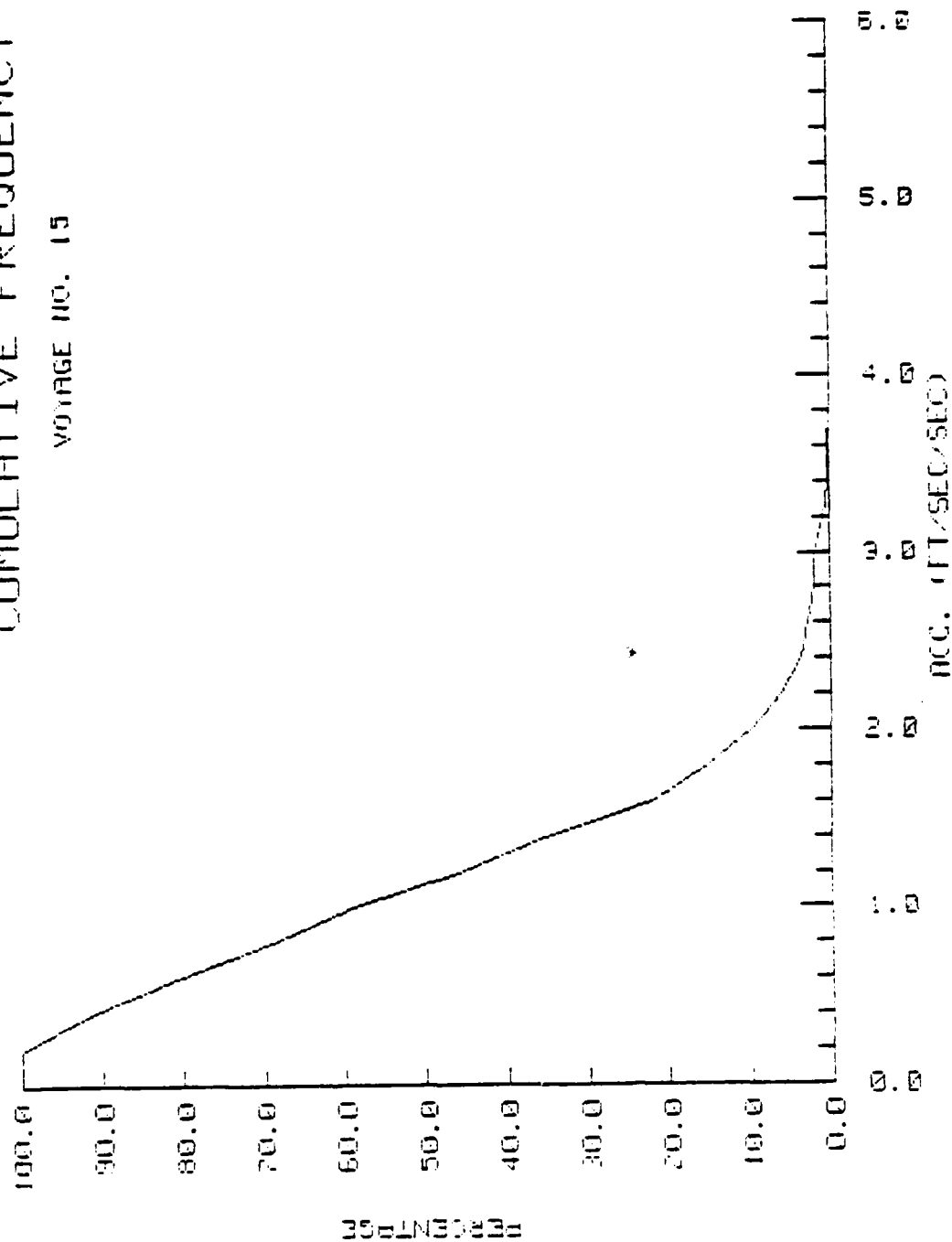
VOTAGE NO. 15





# CUMULATIVE FREQUENCY

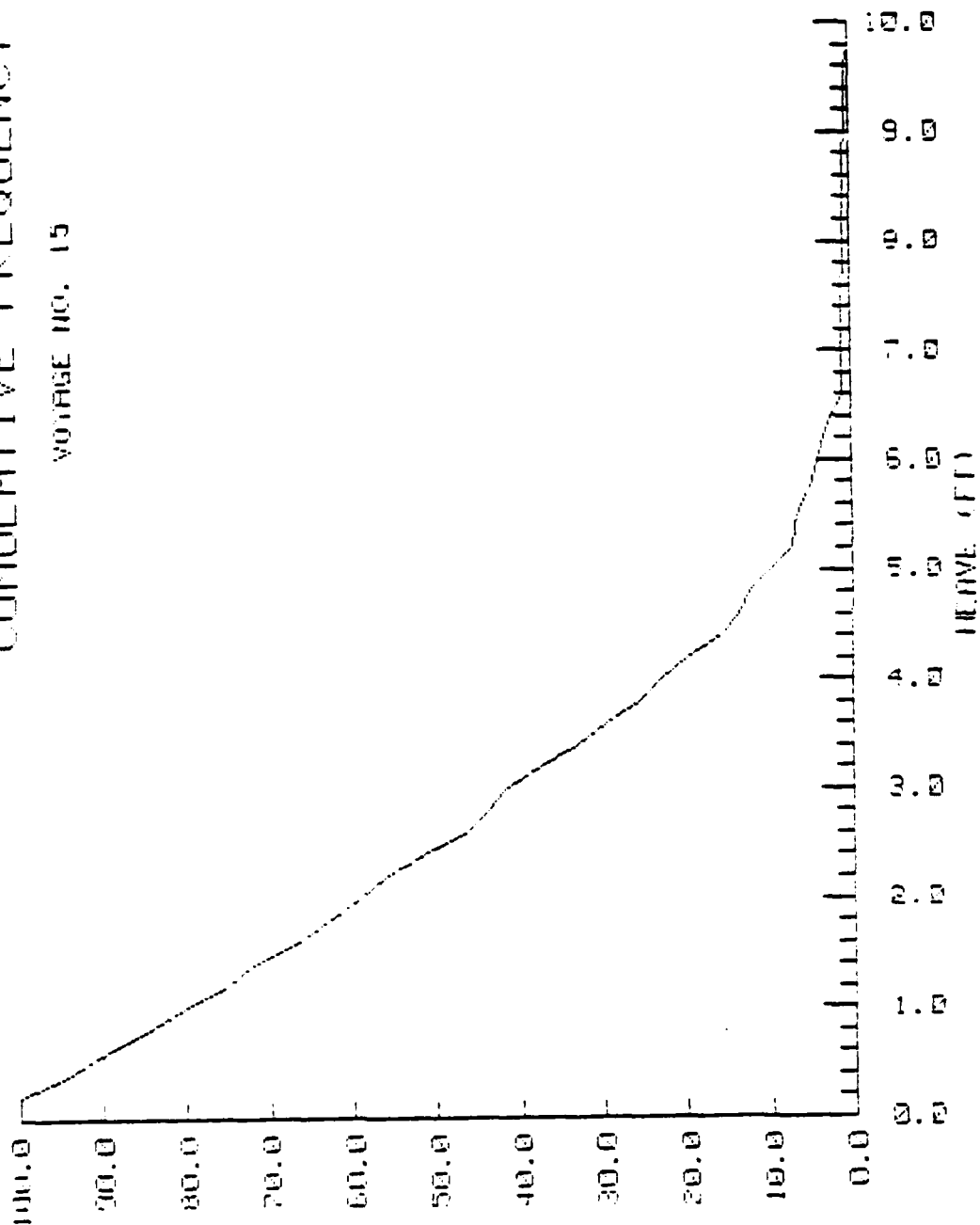
VOTAGE NO. 15





# CUMULATIVE FREQUENCY

VOLTAGE NO. 15

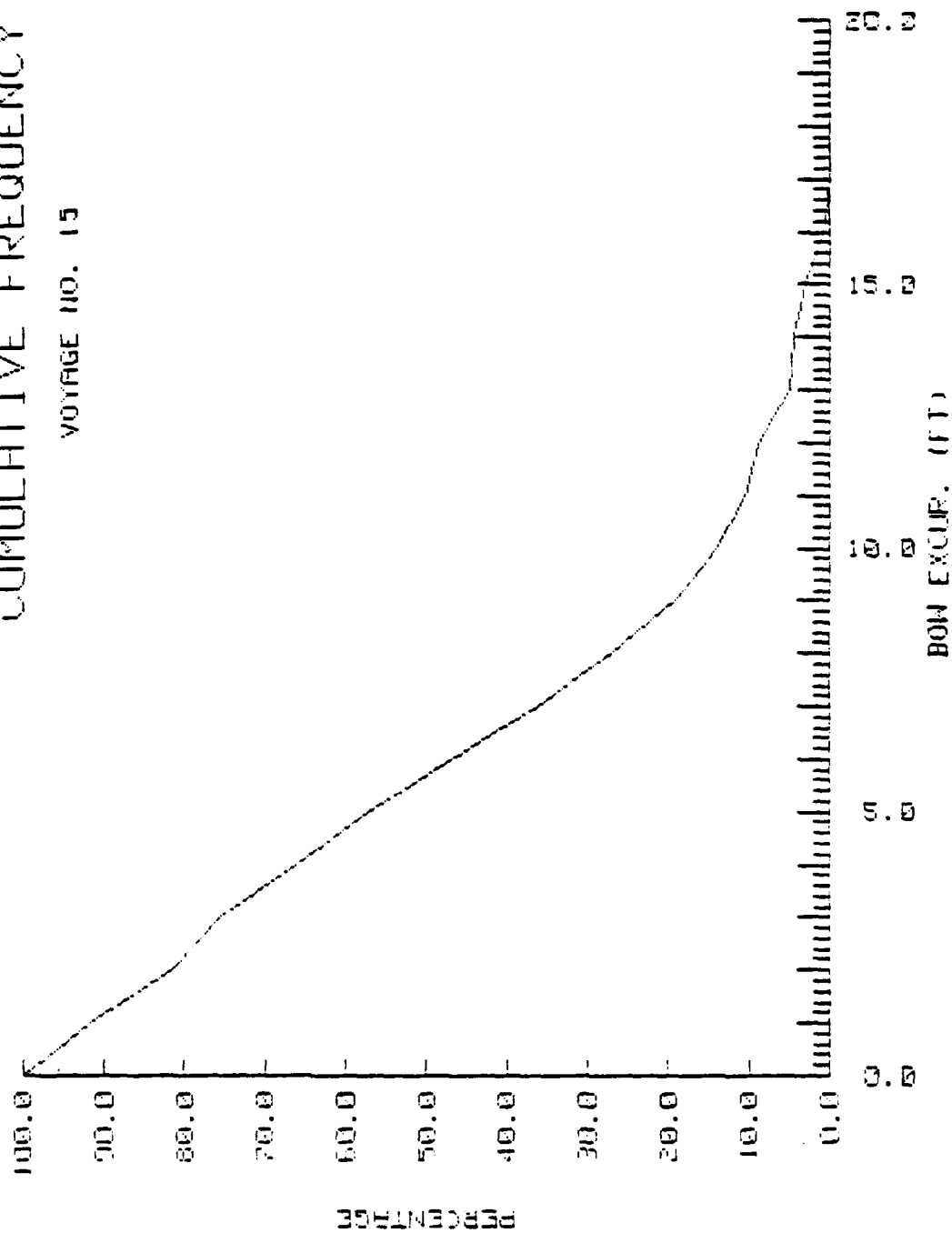


100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 0.0



# CUMULATIVE FREQUENCY

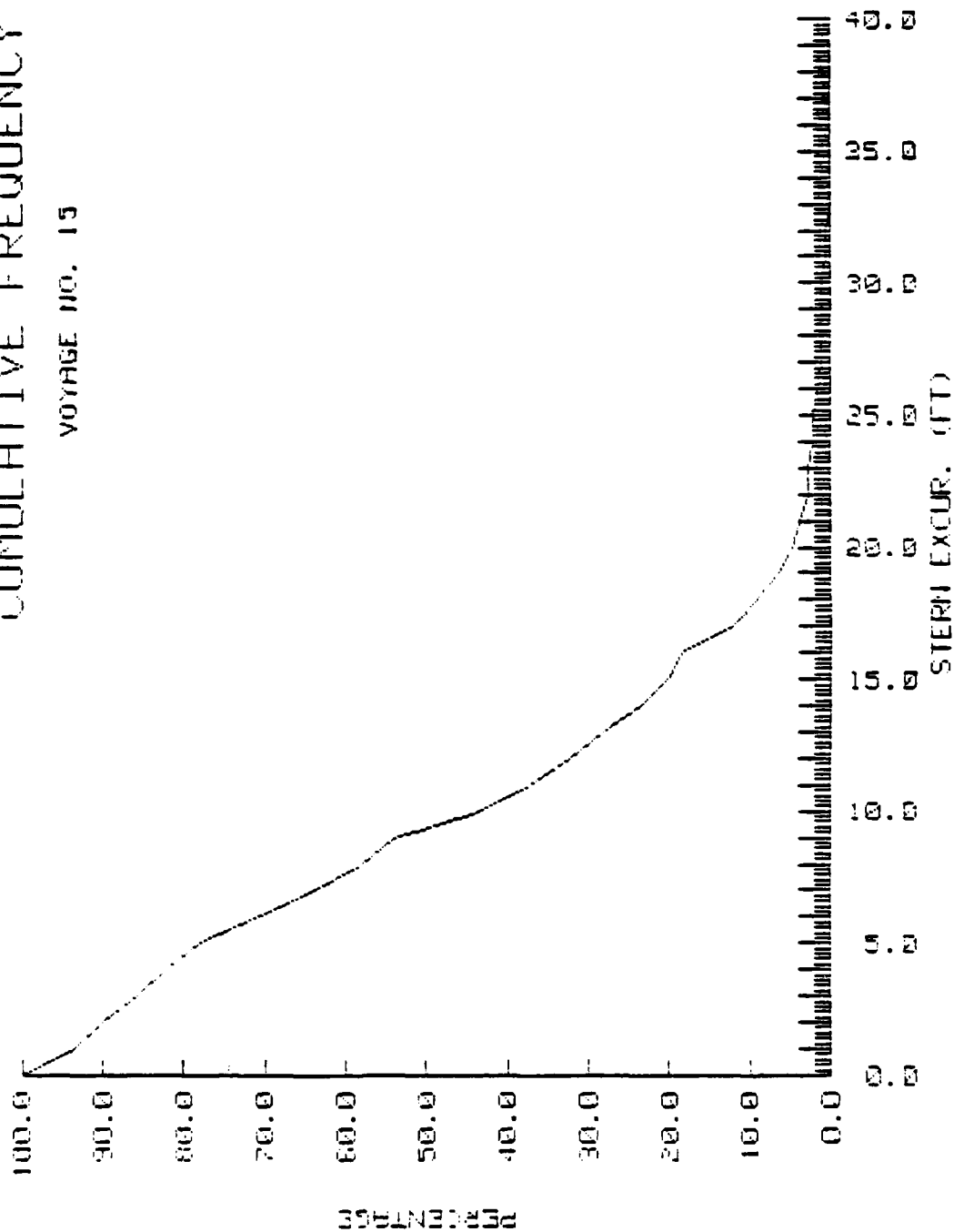
VOYAGE NO. 15





# CUMULATIVE FREQUENCY

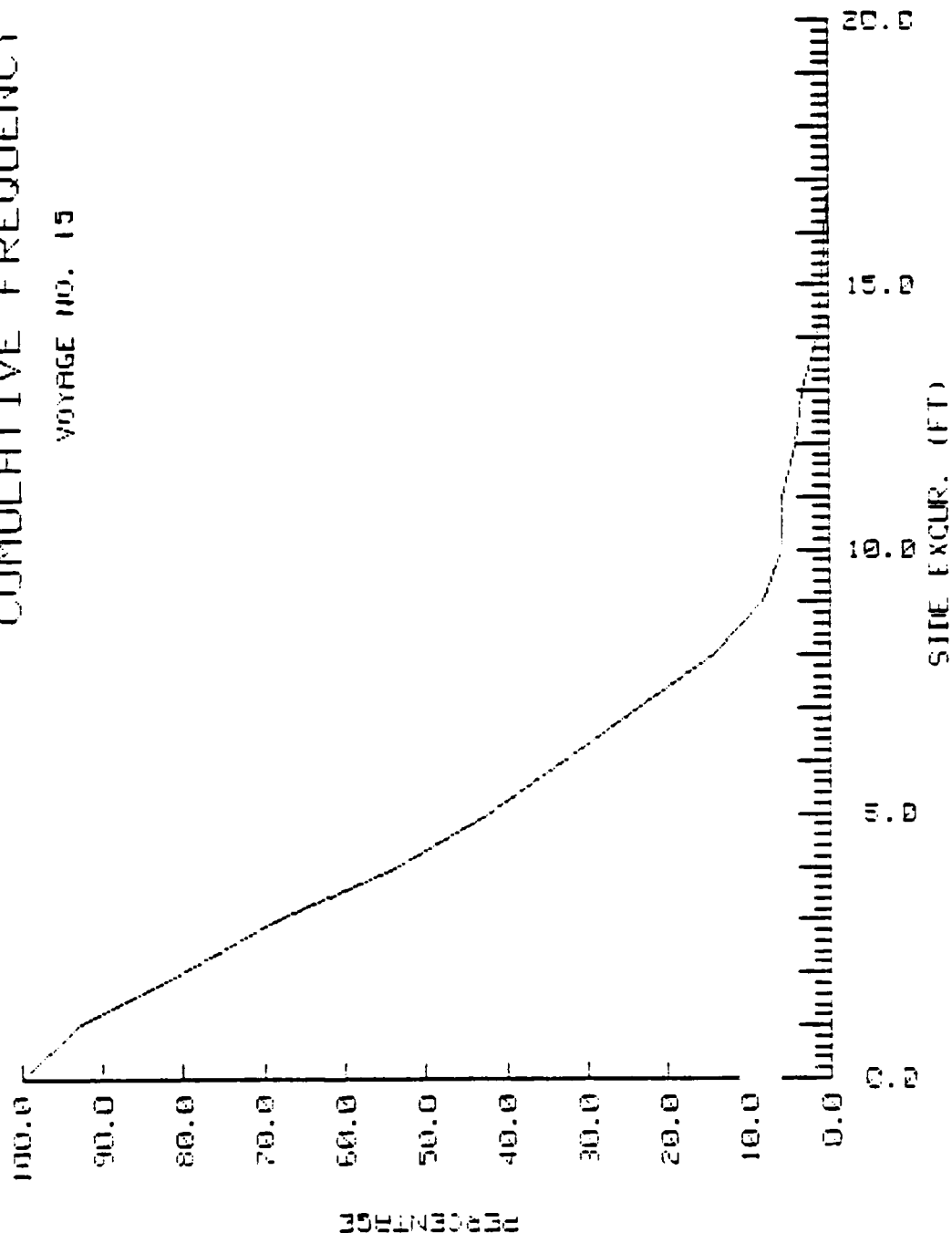
VOYAGE NO. 15





# CUMULATIVE FREQUENCY

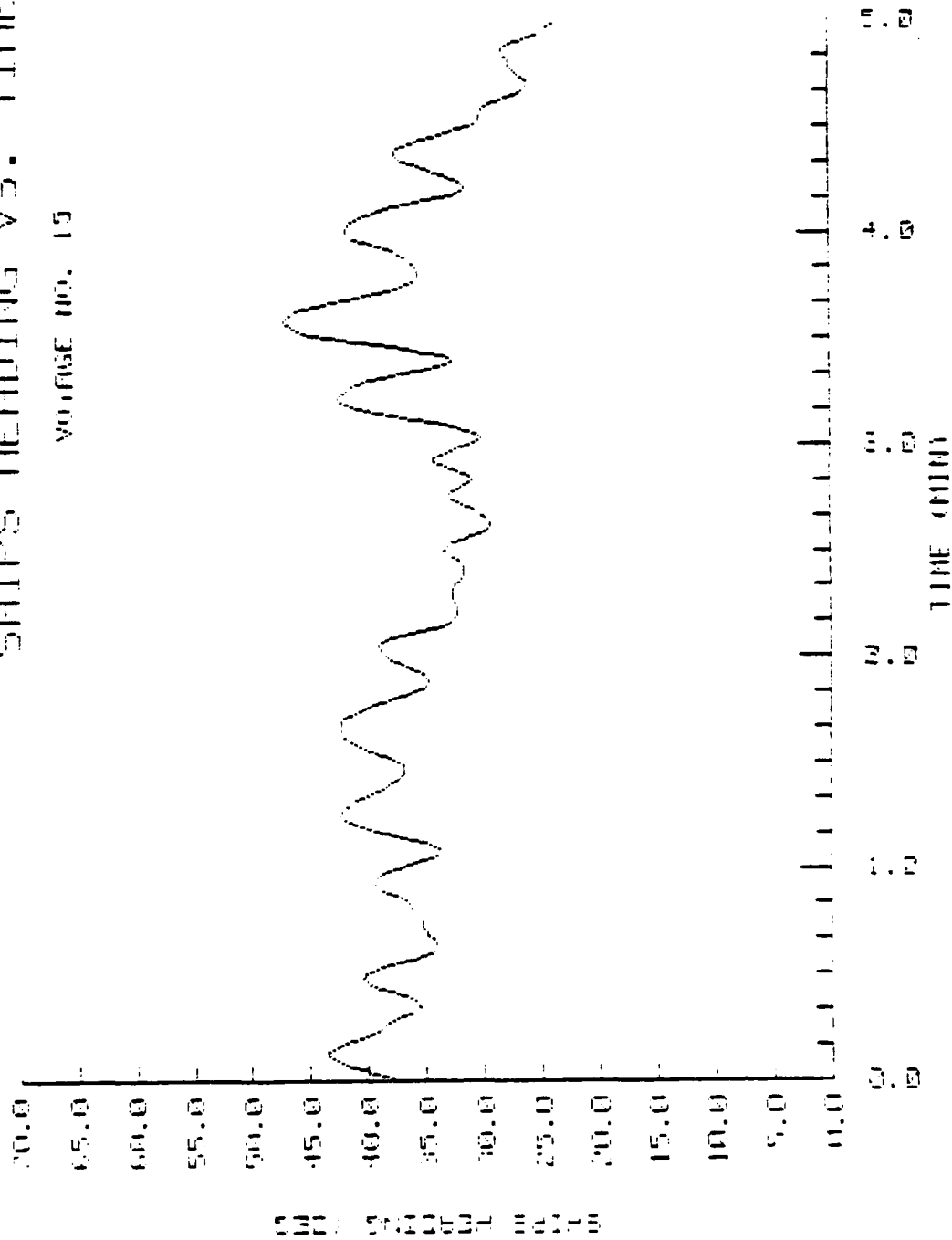
VOYAGE NO. 15





# SHIPS HEADING VS. TIME

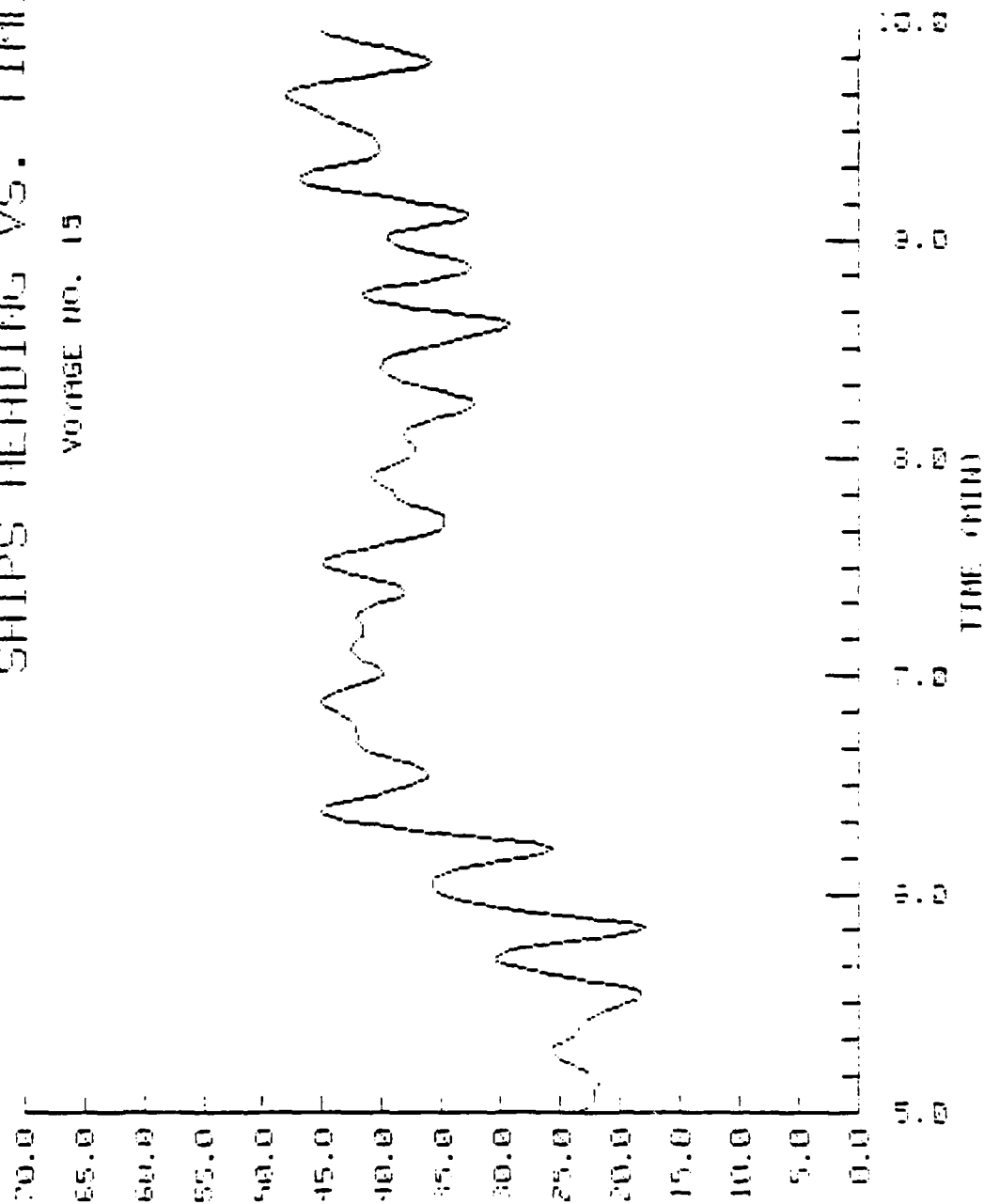
VOYAGE NO. 15





# SHIPS HEADING VS. TIME

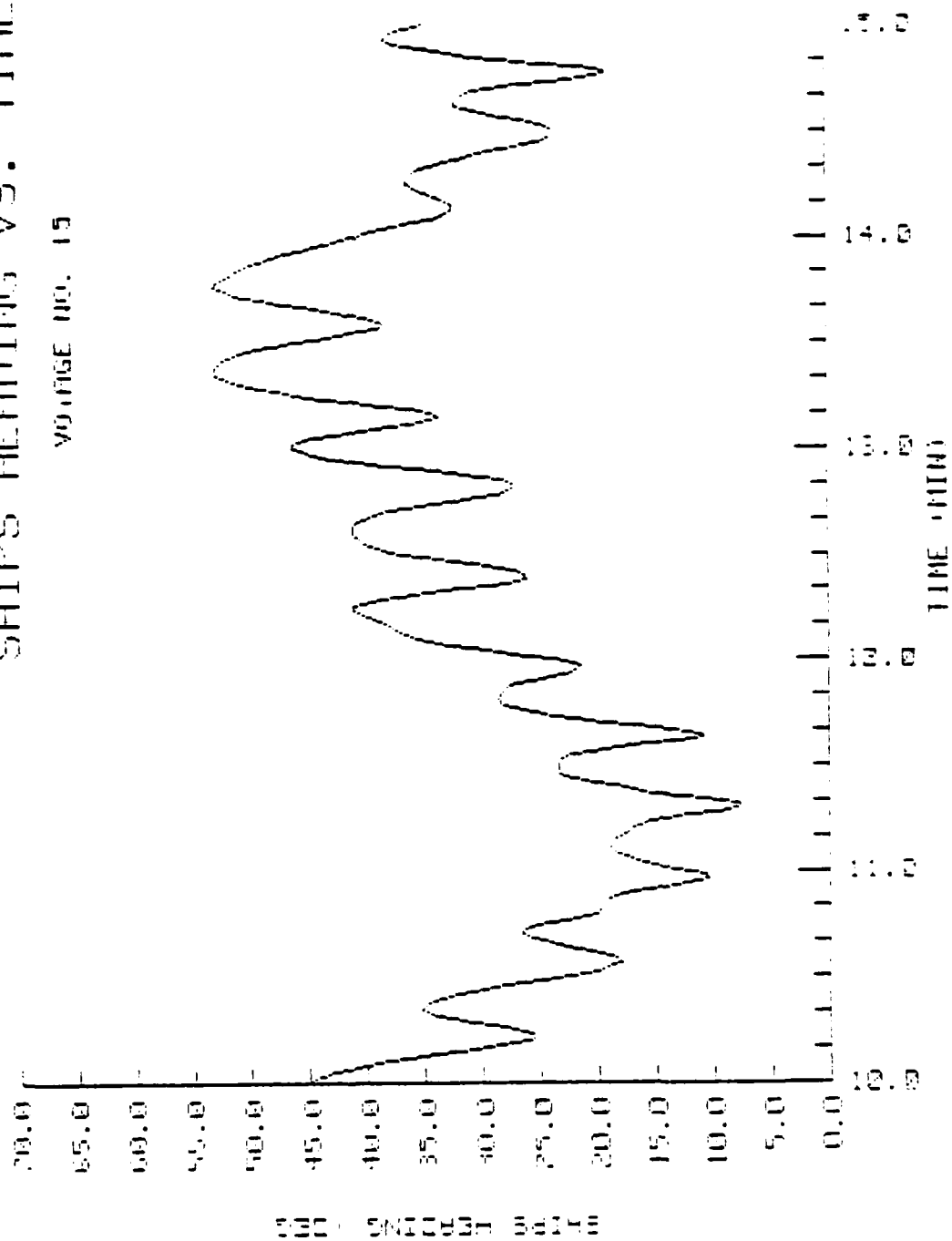
VOLUME NO. 15





# SHIPS HEADING VS. TIME

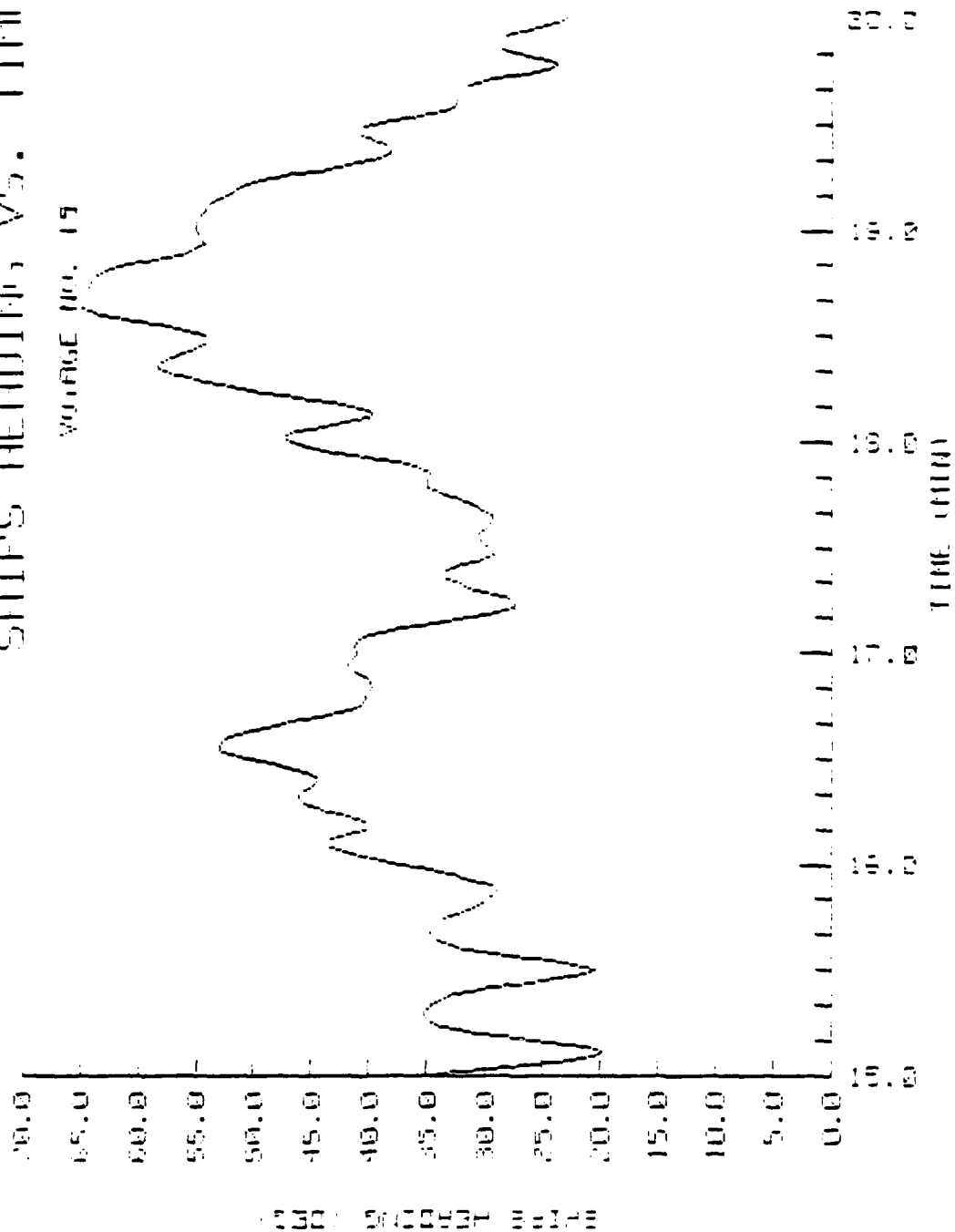
VOYAGE NO. 15





# SHIPS HEADING VS. TIME

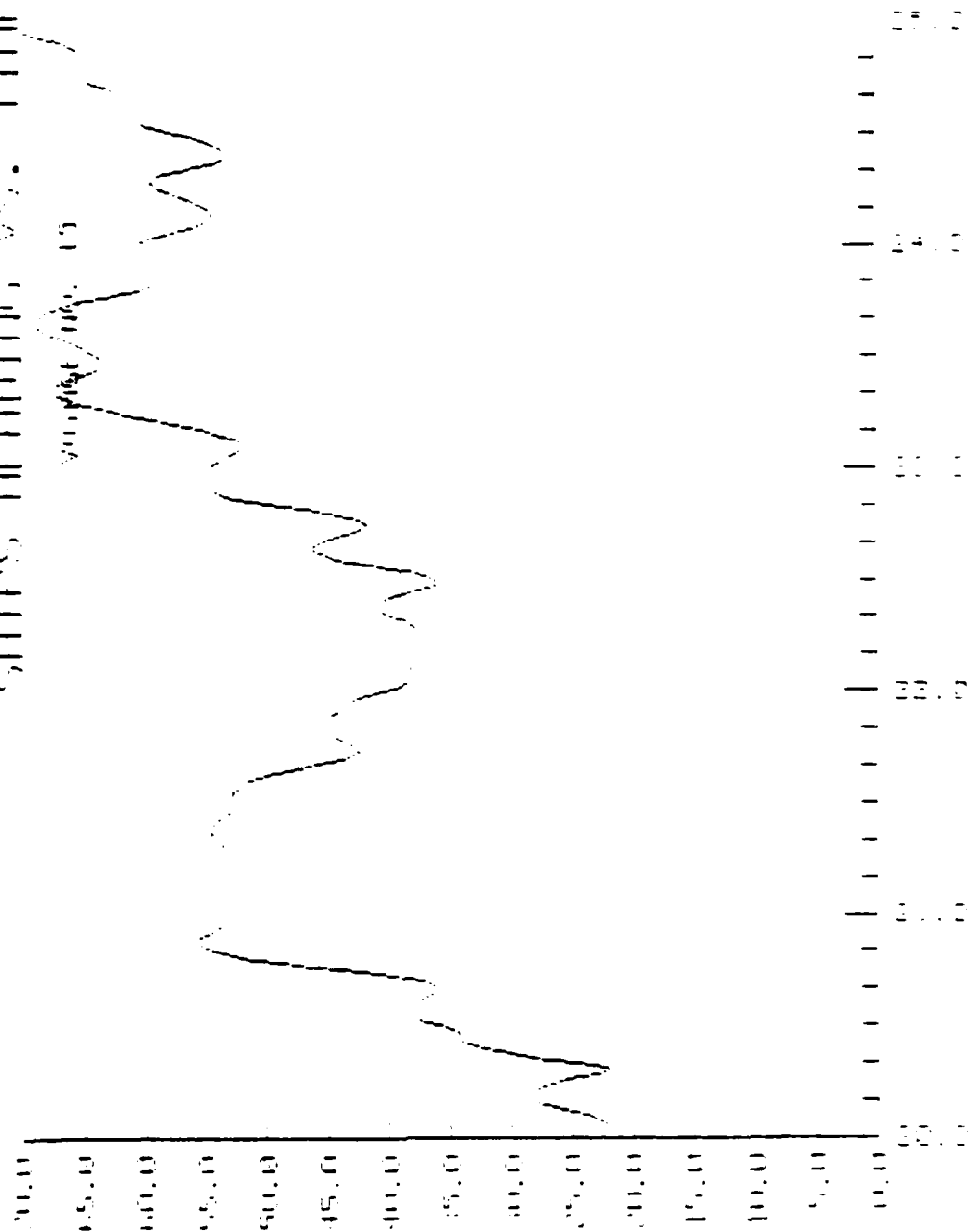
VOLUME NO. 15





SHIPS IN PORT, VS. TIME

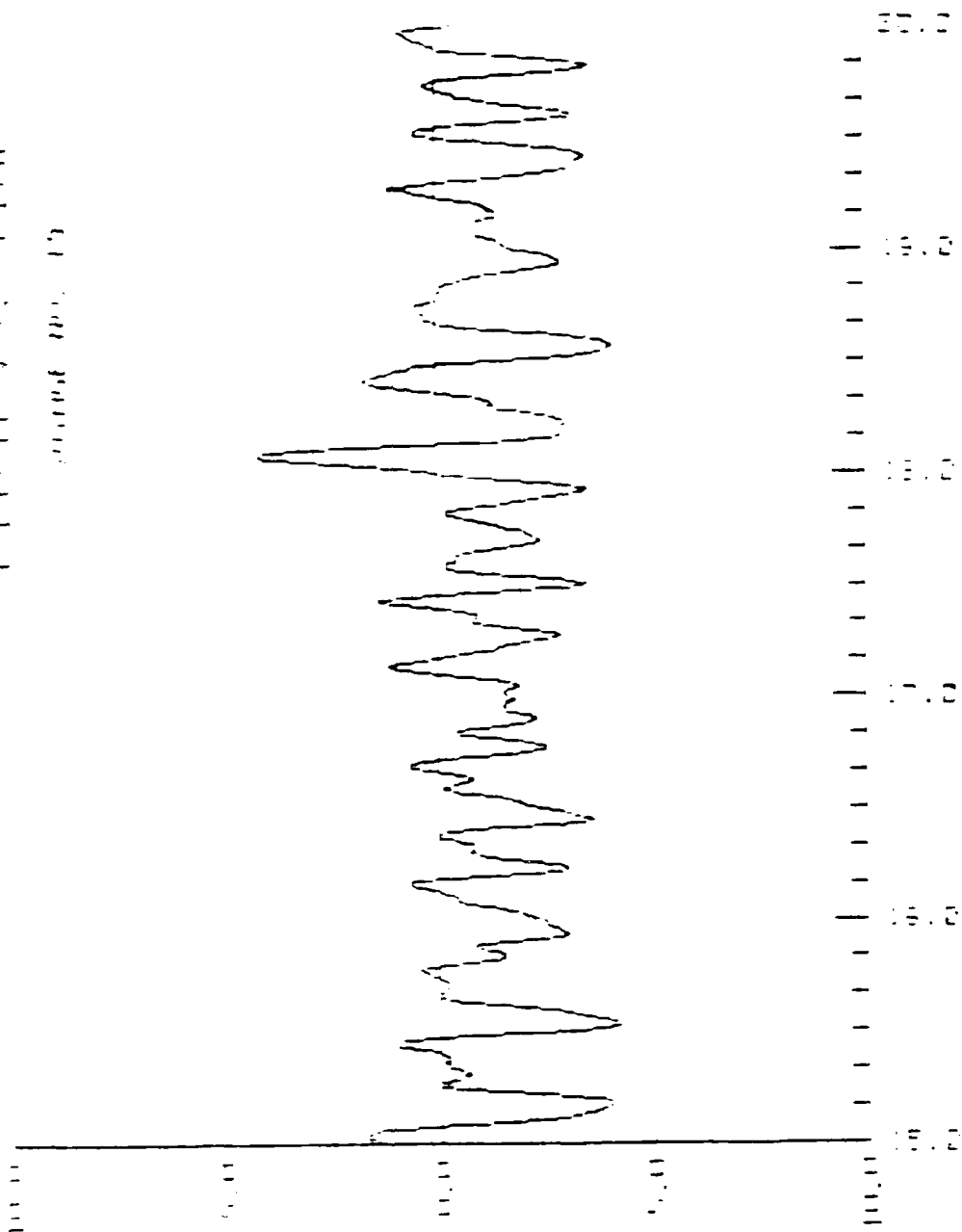
1944-1945



1944 1945



11111 11111 11111  
11111 11111 11111

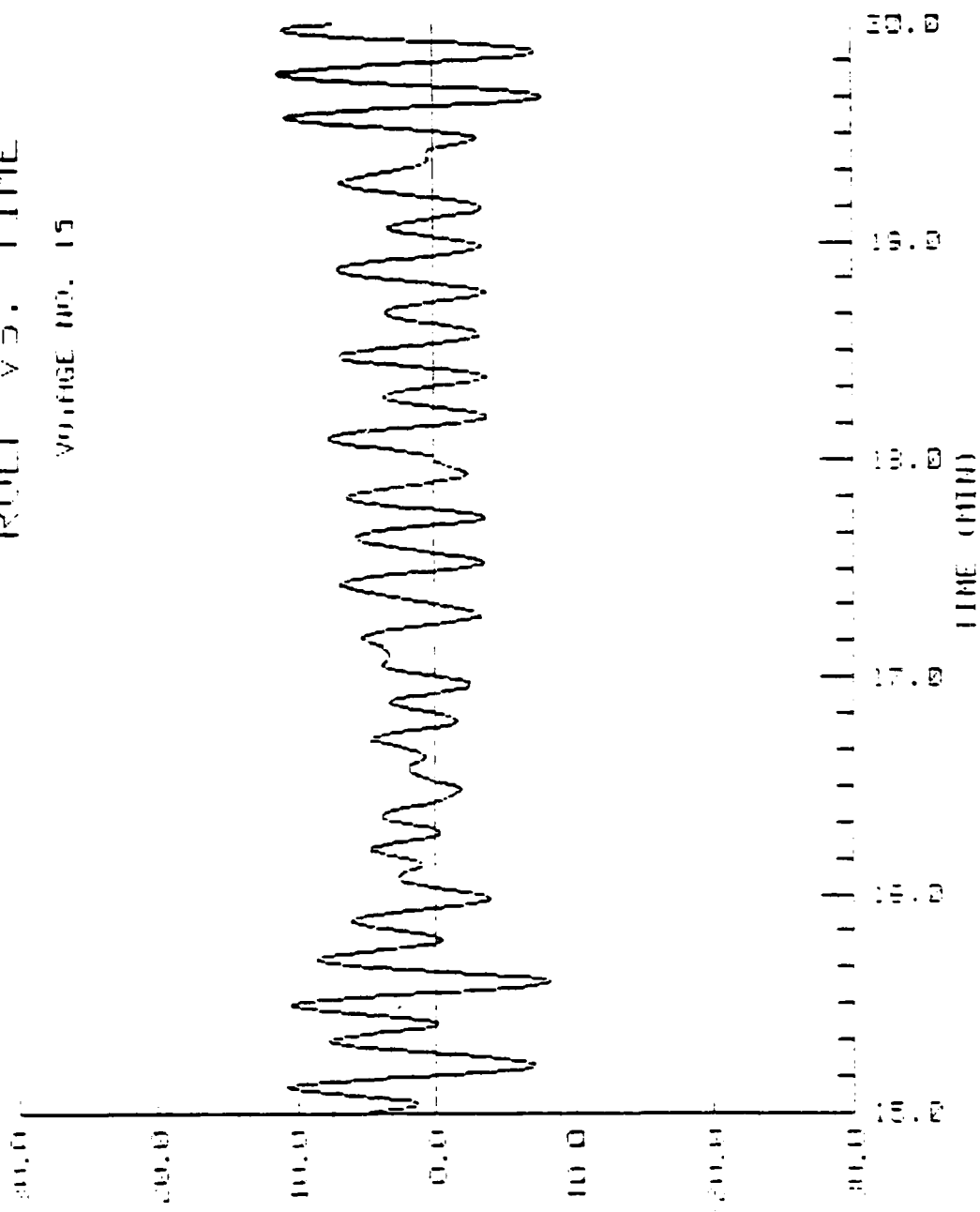


11111 11111



ROLL VS. TIME

VOLUME NO. 15

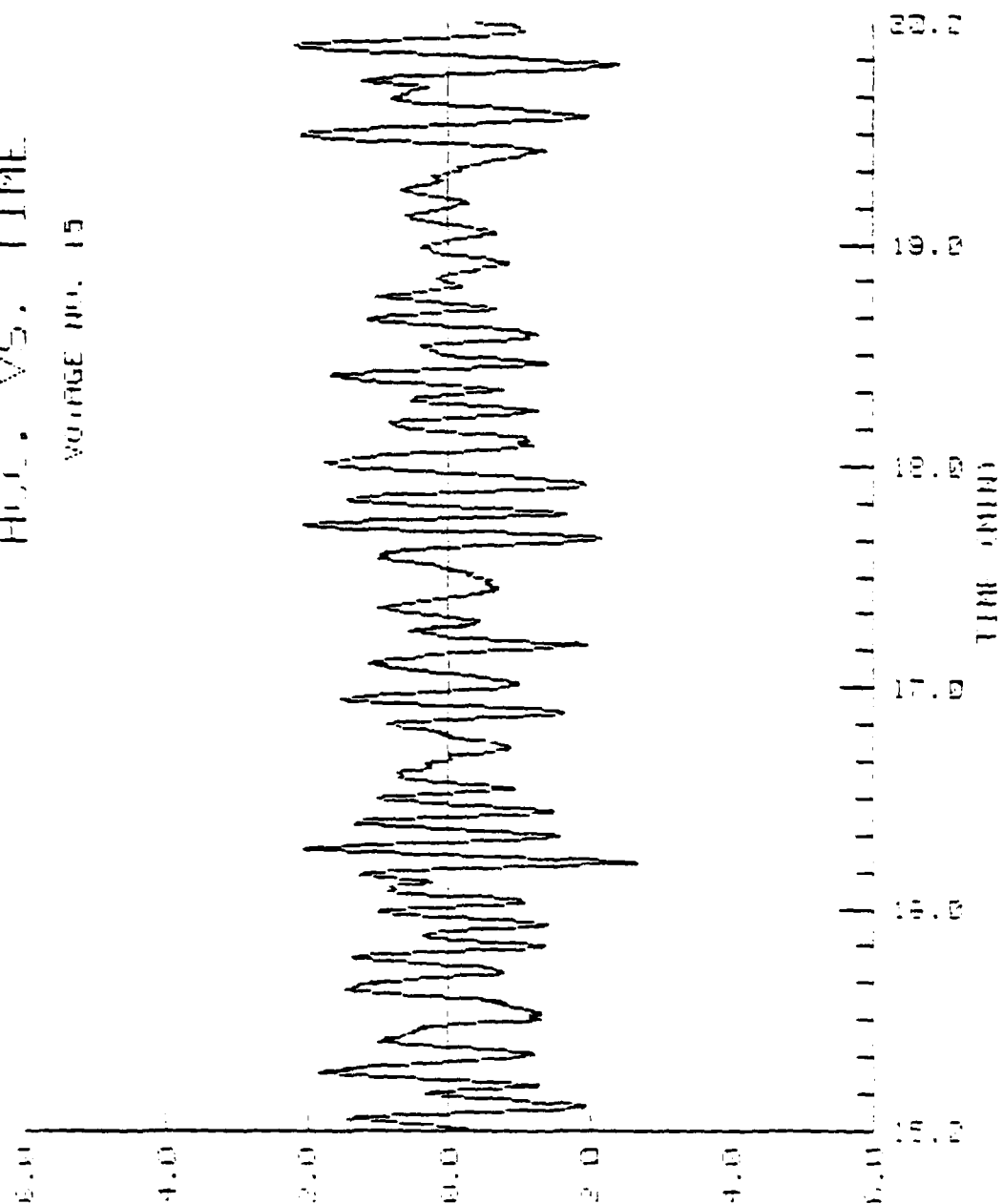


1000 1000



ACC. VS. TIME

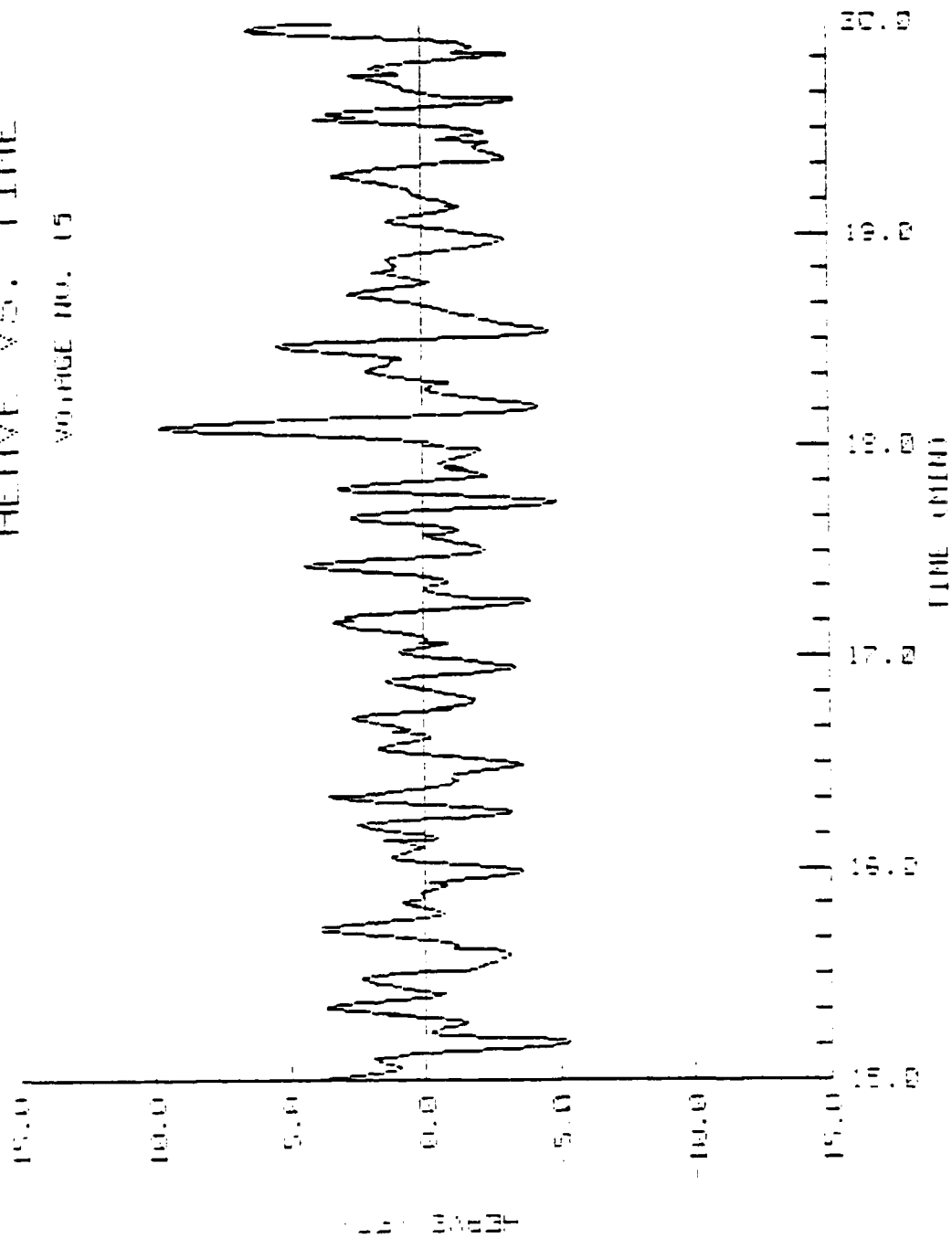
VOLUME NO. 15





HEAVE VS. TIME

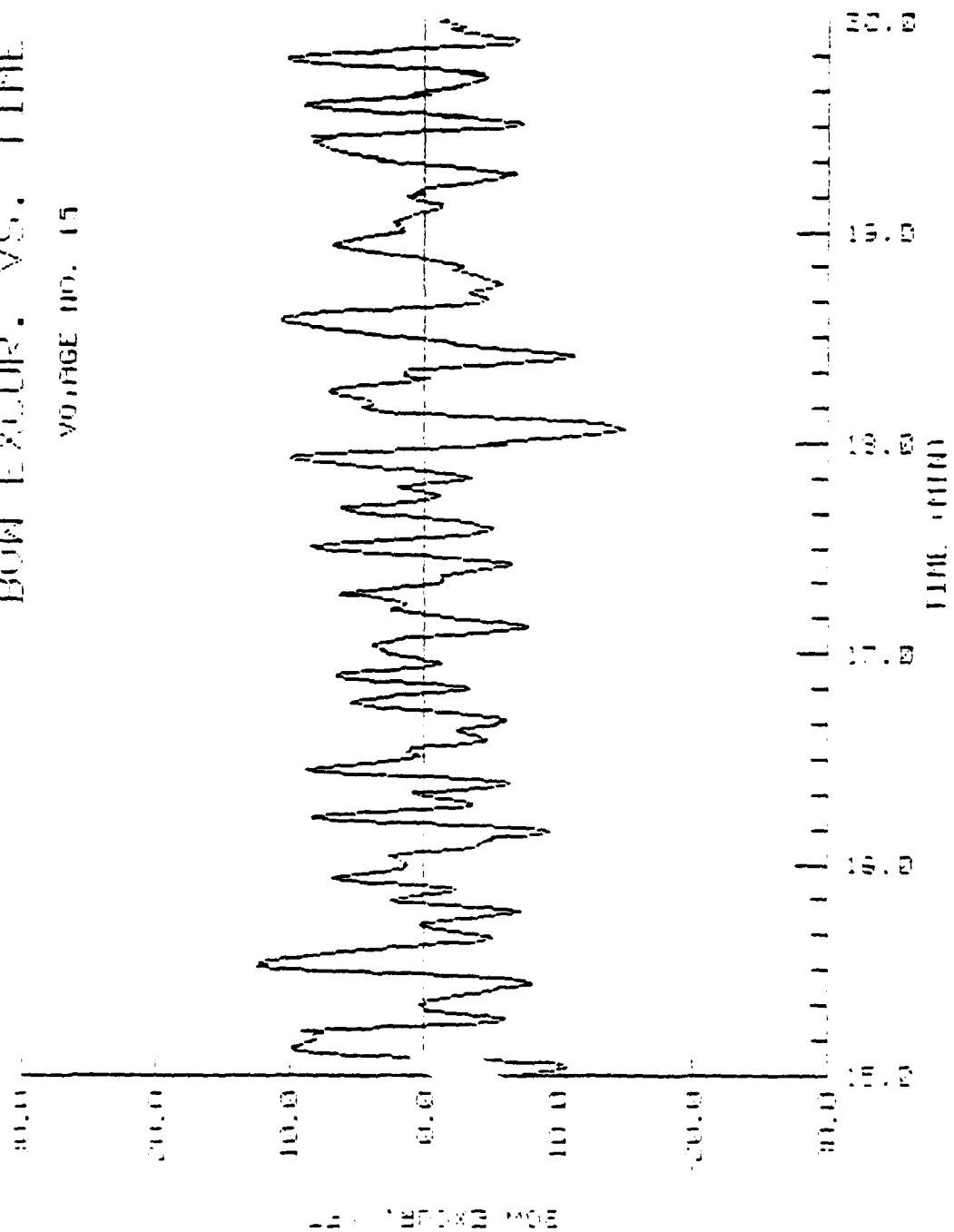
VOICE NO. 15





BOW EXCUR. VS. TIME

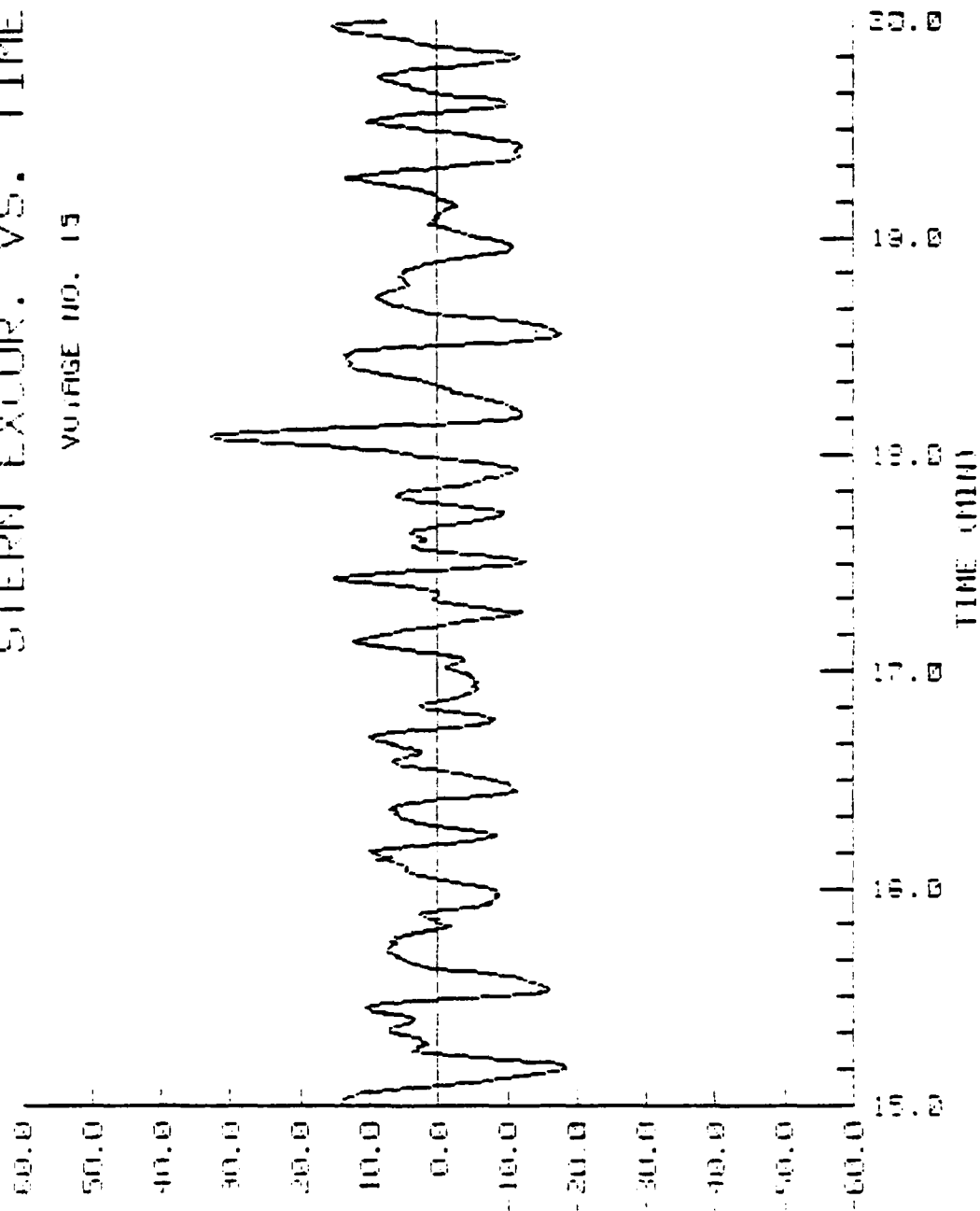
VOLTAGE 110.15





# STERN EXCUR. VS. TIME

VOLUME NO. 15

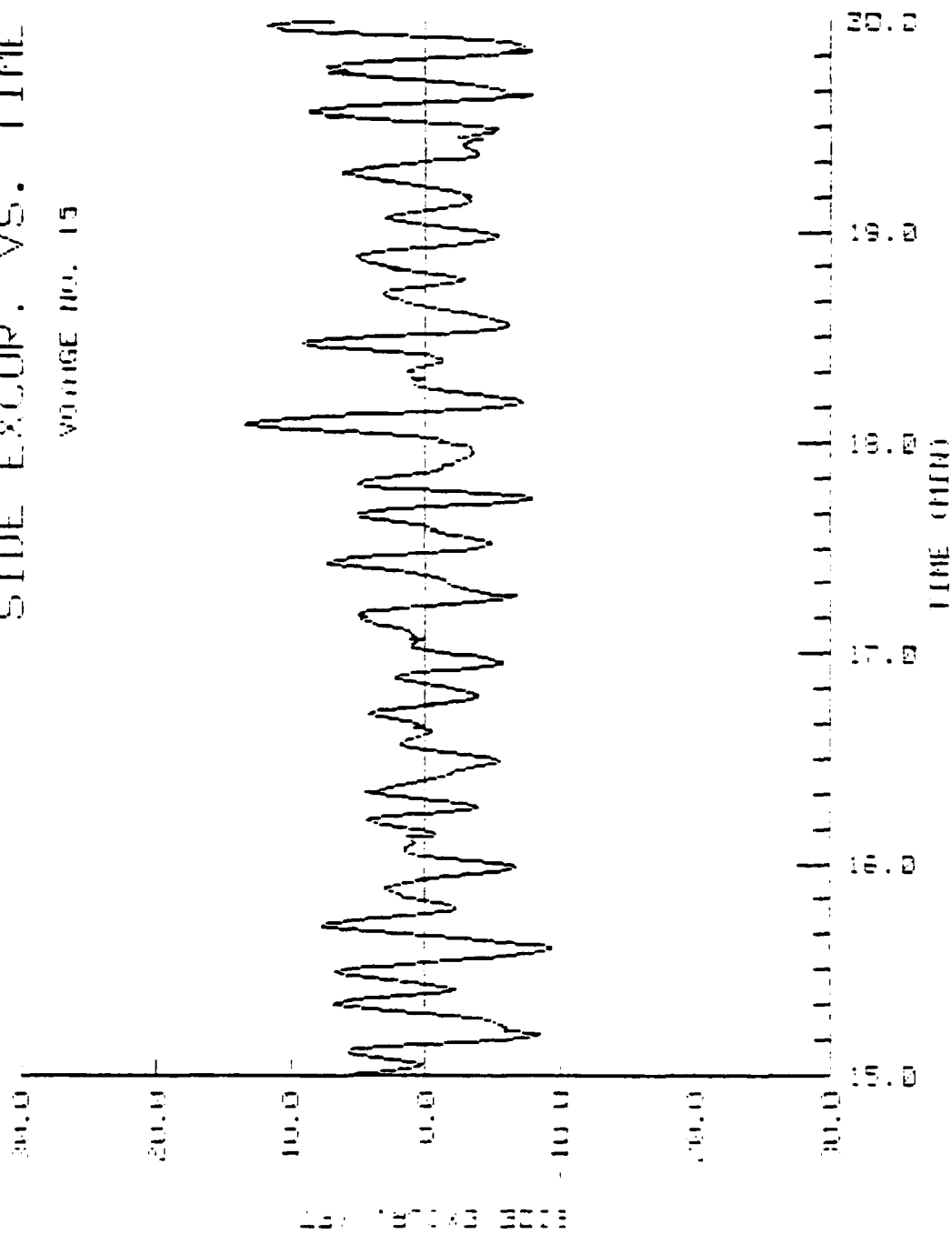


15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0



# SIDE EXCUR. VS. TIME

WOMGE NO. 15





# STATISTICAL SUMMARY

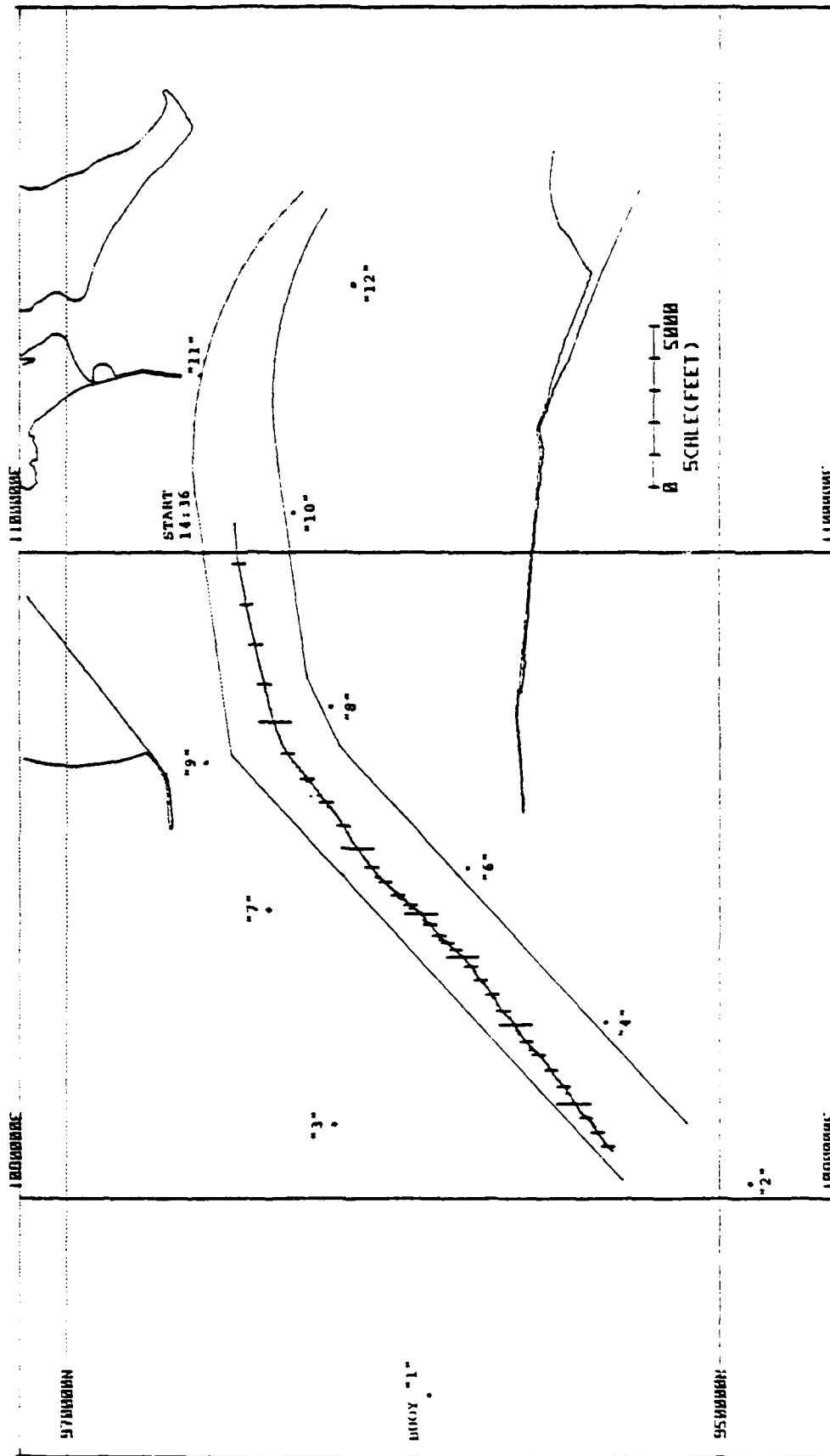
VOYAGE NO. 16

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	FMS
PITCH (DEG)	-0.9	4.9	2.4	2.6
ROLL (DEG)	.6	13.0	5.8	6.4
YAW (FT/SEC/SEC)	-0.1	5.3	2.0	2.3
HEAVE (FT)	.2	8.3	2.3	2.7
ROLL EXCUR. (FT)	.2	21.6	9.9	10.9
PITCH EXCUR. (FT)	.2	27.9	11.4	12.6
YAW EXCUR. (FT)	.2	12.7	4.0	4.7



# VOYAGE NO. 16 SHIP TRACK

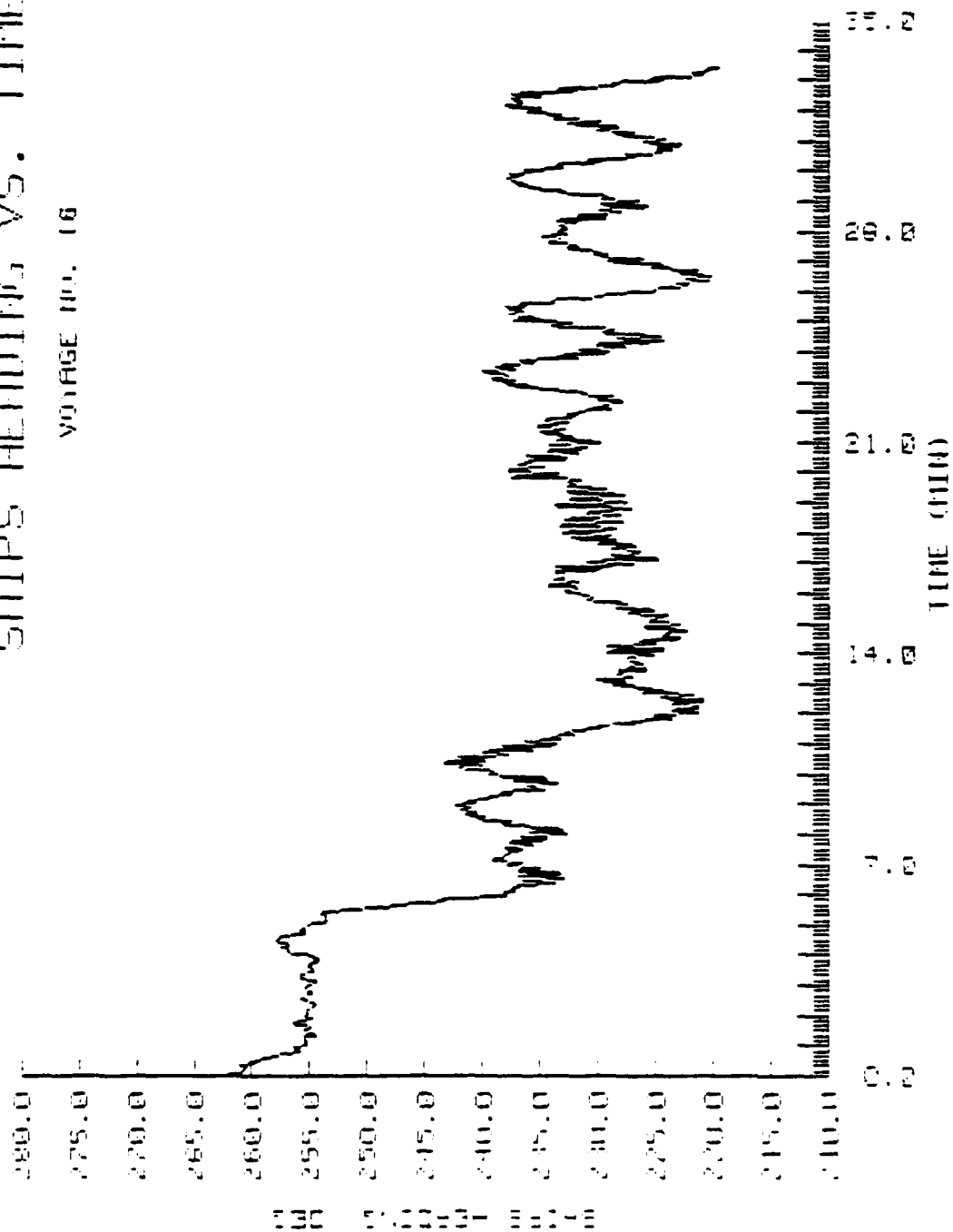
SCALE 1:30000





# SHIPS HEADING VS. TIME

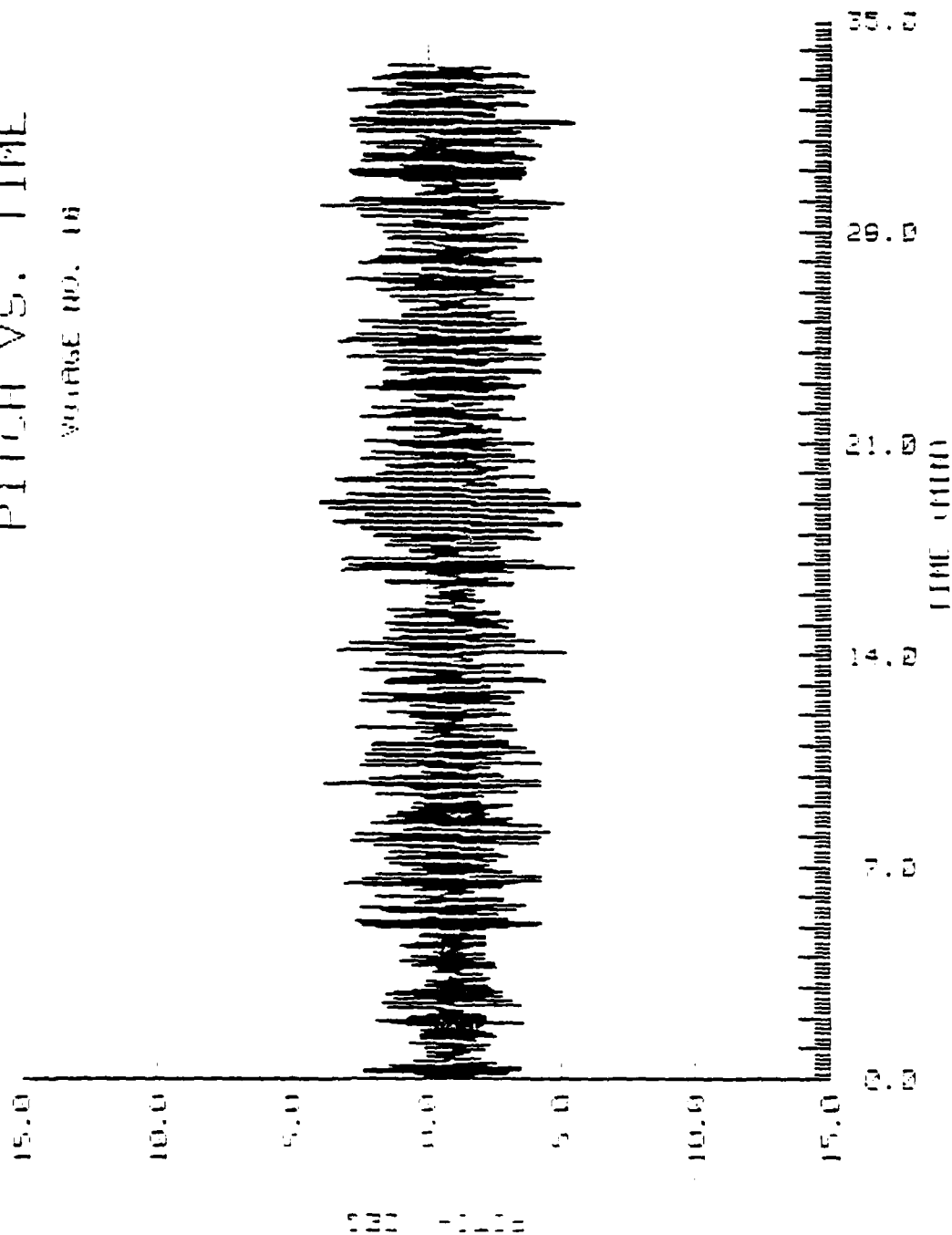
VOLUME NO. 16





# PITCH VS. TIME

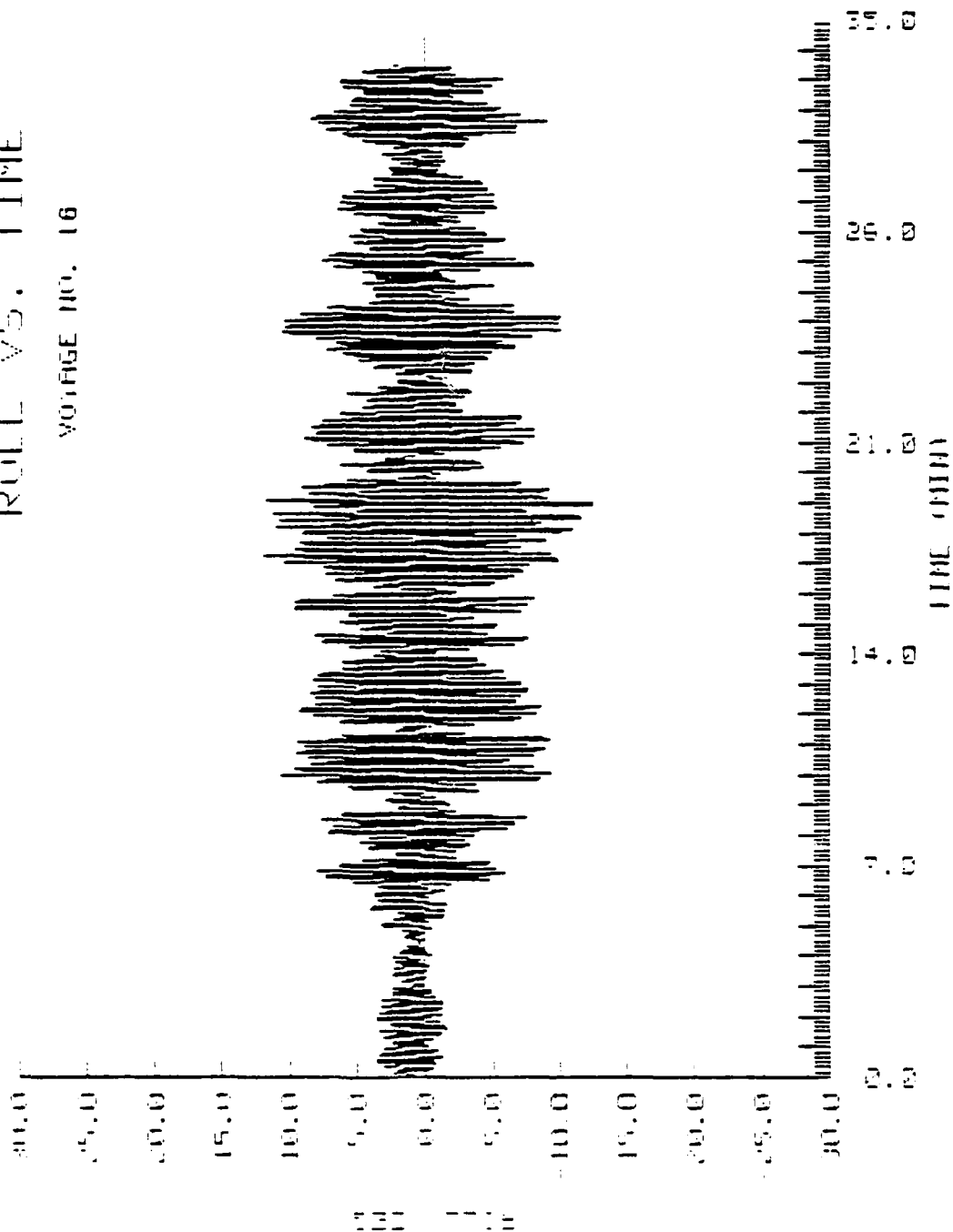
VOLUME NO. 10





# ROLL VS. TIME

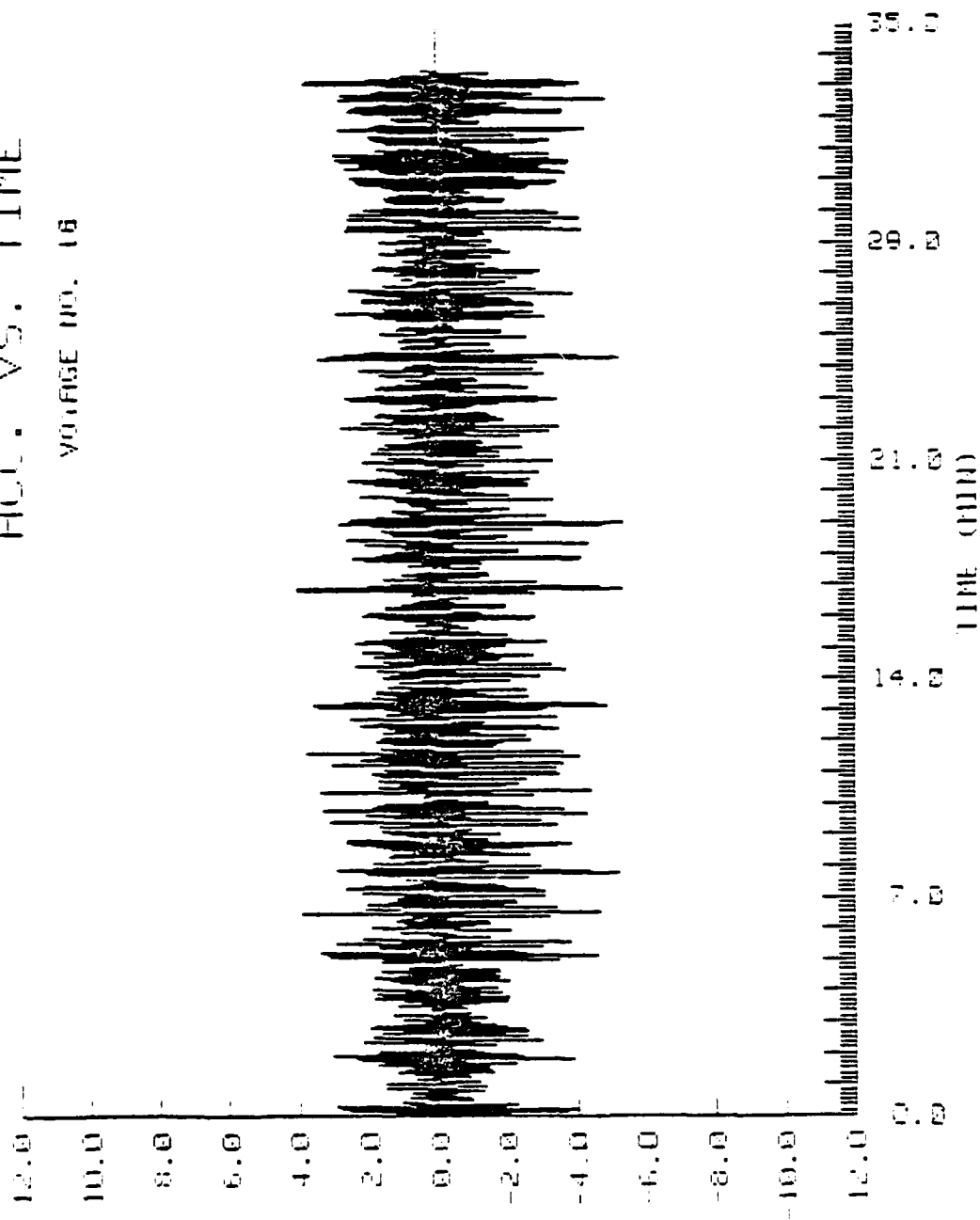
VOLUME NO. 16





# ACC. VS. TIME

VOLUME NO. 16

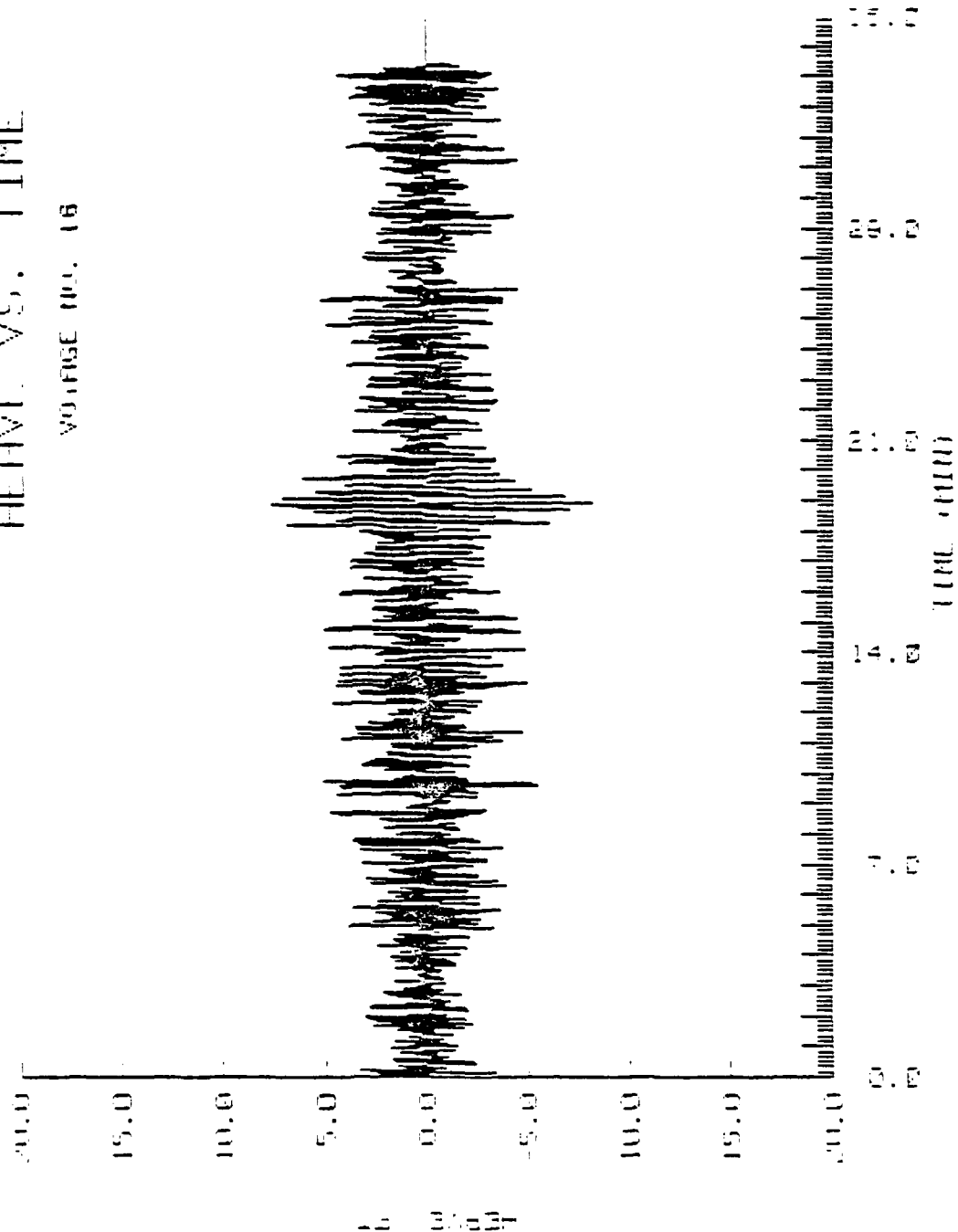


1000 1000 1000 1000 1000



# HEPVL VS. TIME

VOLUME 100. 16

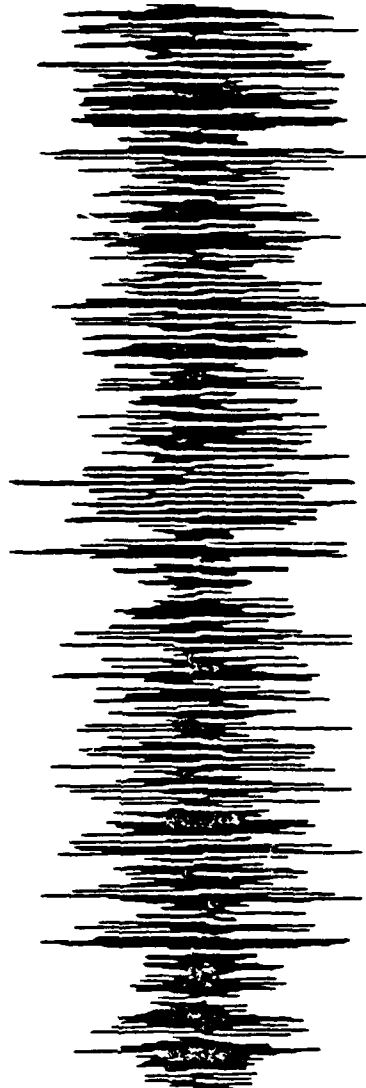




13004 1 20 00P. 7/55. 1 1111

MOUSE 100. 10

00.00  
10.00  
20.00  
30.00  
40.00  
50.00  
60.00  
70.00  
80.00  
90.00



00.00  
10.00  
20.00  
30.00  
40.00  
50.00  
60.00  
70.00  
80.00  
90.00

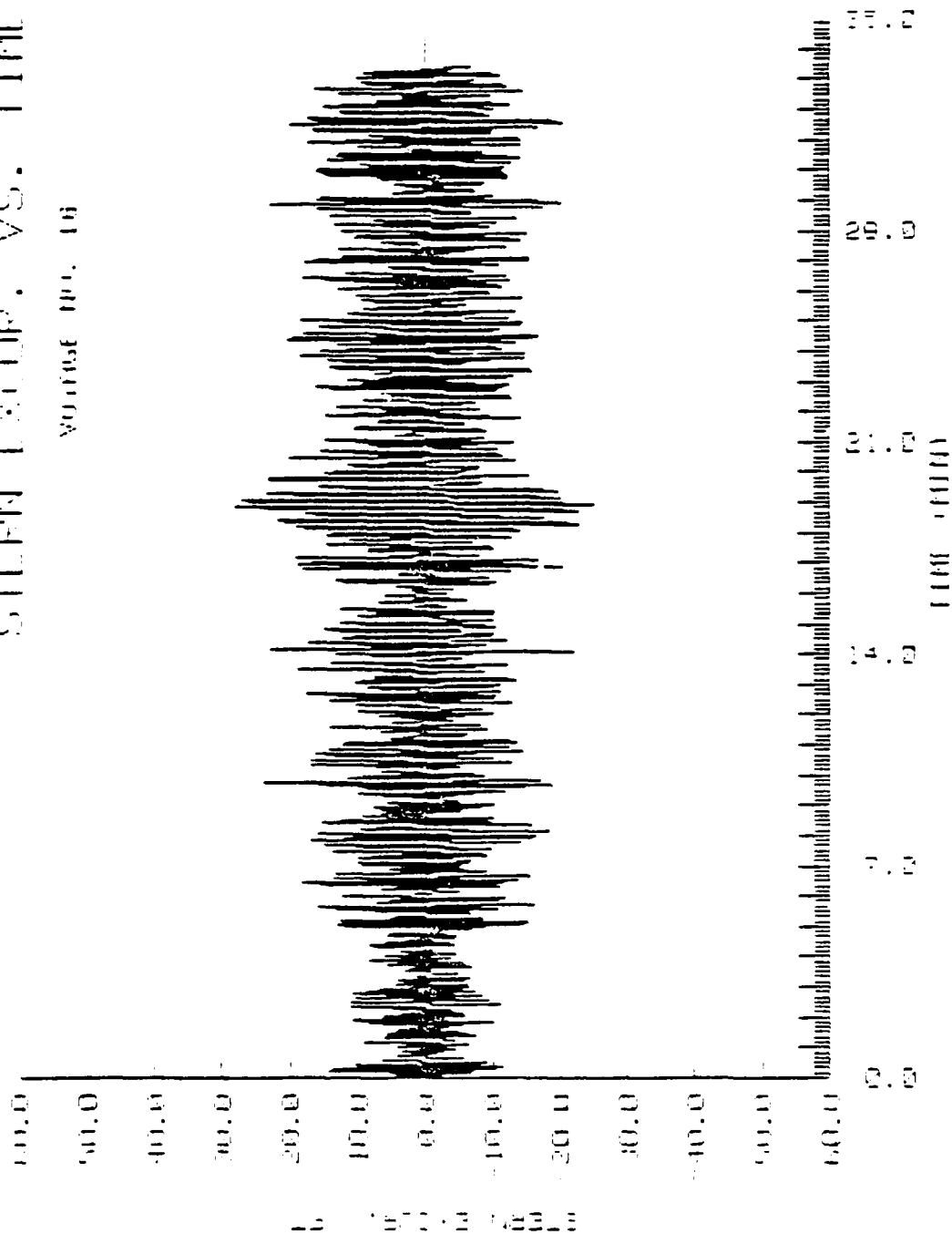
00.00  
10.00  
20.00  
30.00  
40.00  
50.00  
60.00  
70.00  
80.00  
90.00

1111 111111



# SLEEP DEPRIV. VS. TIME

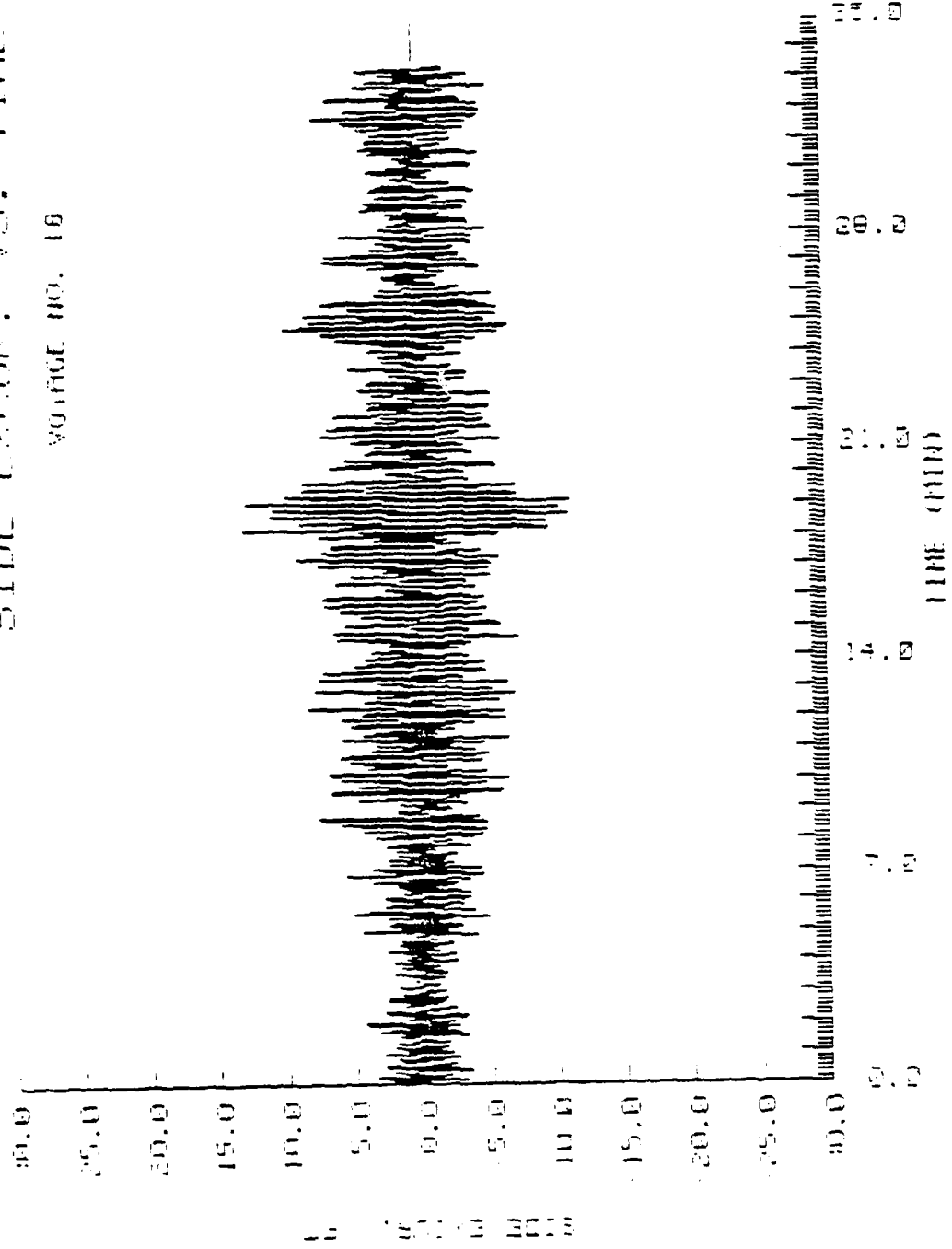
VOLUME 100. 10





# SIDE EXCUR. VS. TIME

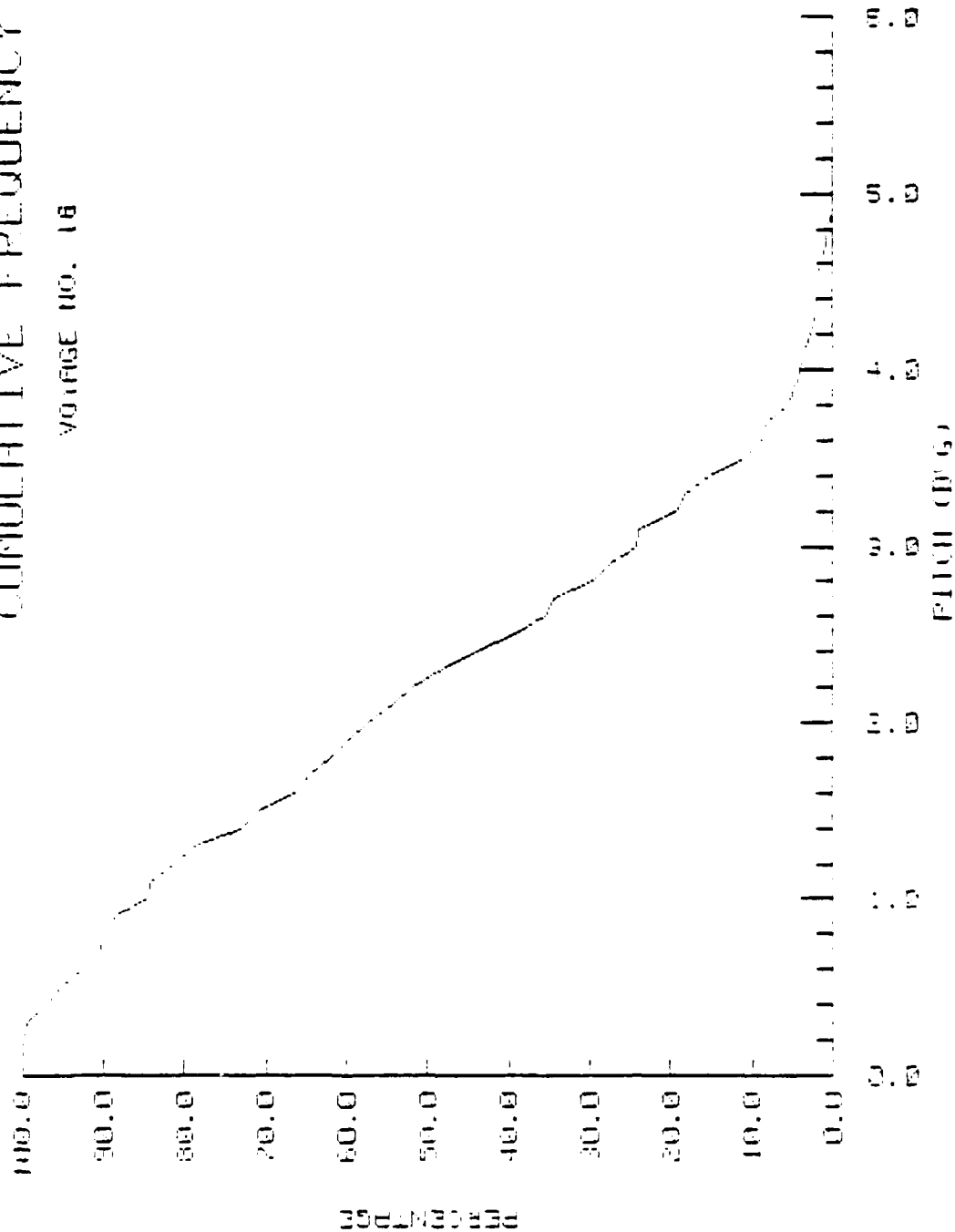
VOYAGE NO. 18





# CUMULATIVE FREQUENCY

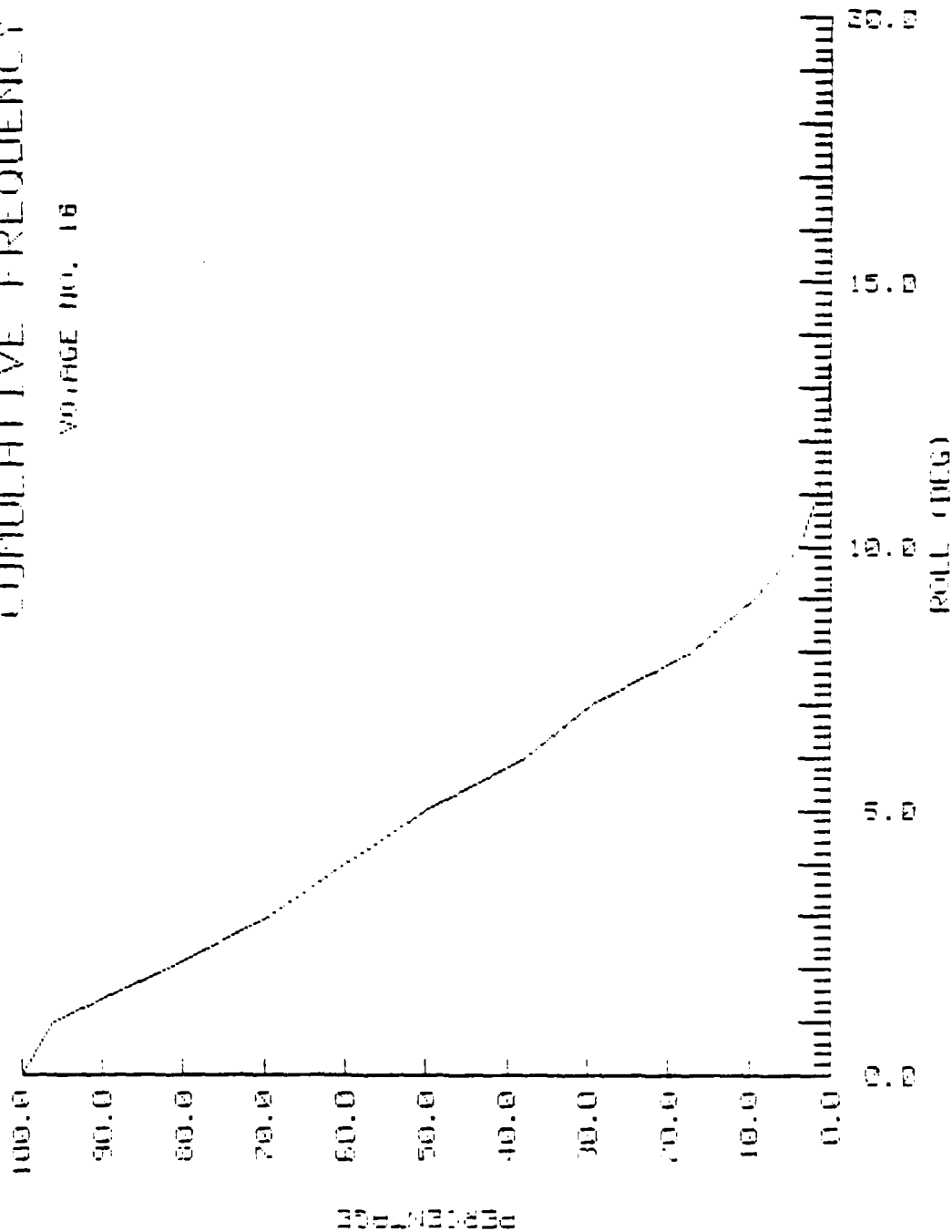
VOLAGE NO. 18





# CUMULATIVE FREQUENCY

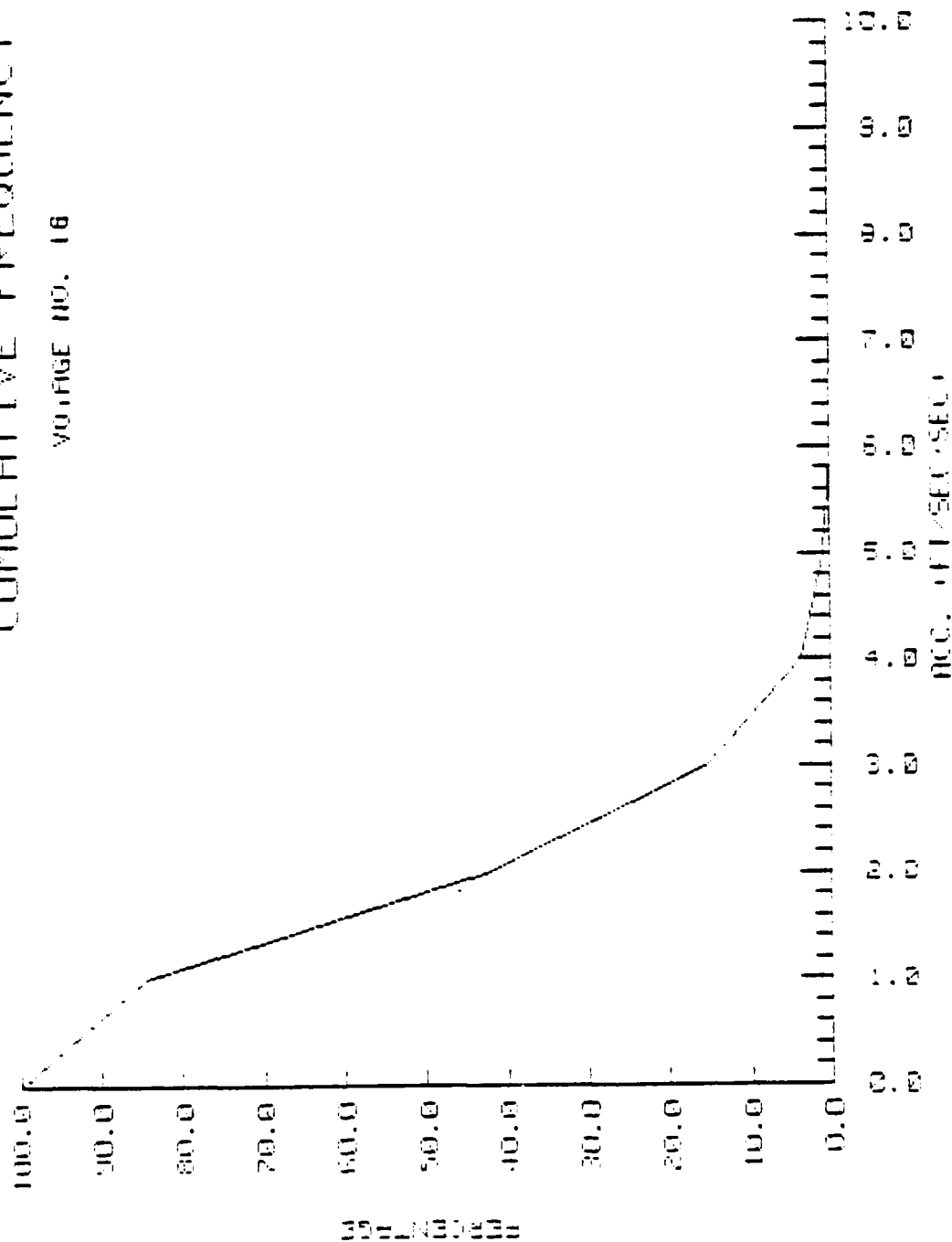
VOLAGE NO. 16





# CUMULATIVE FREQUENCY

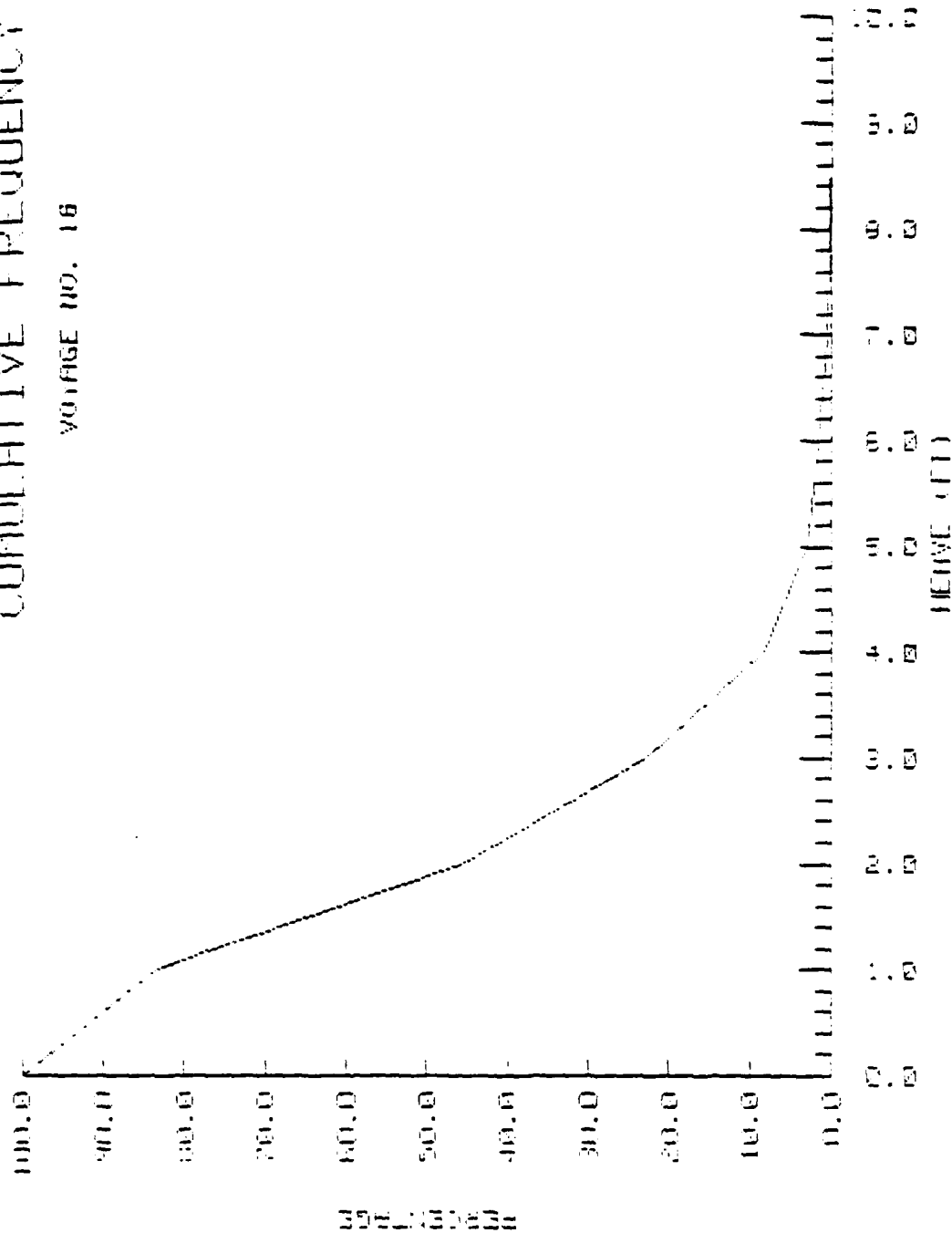
VOLTAG NO. 16





# CUMULATIVE FREQUENCY

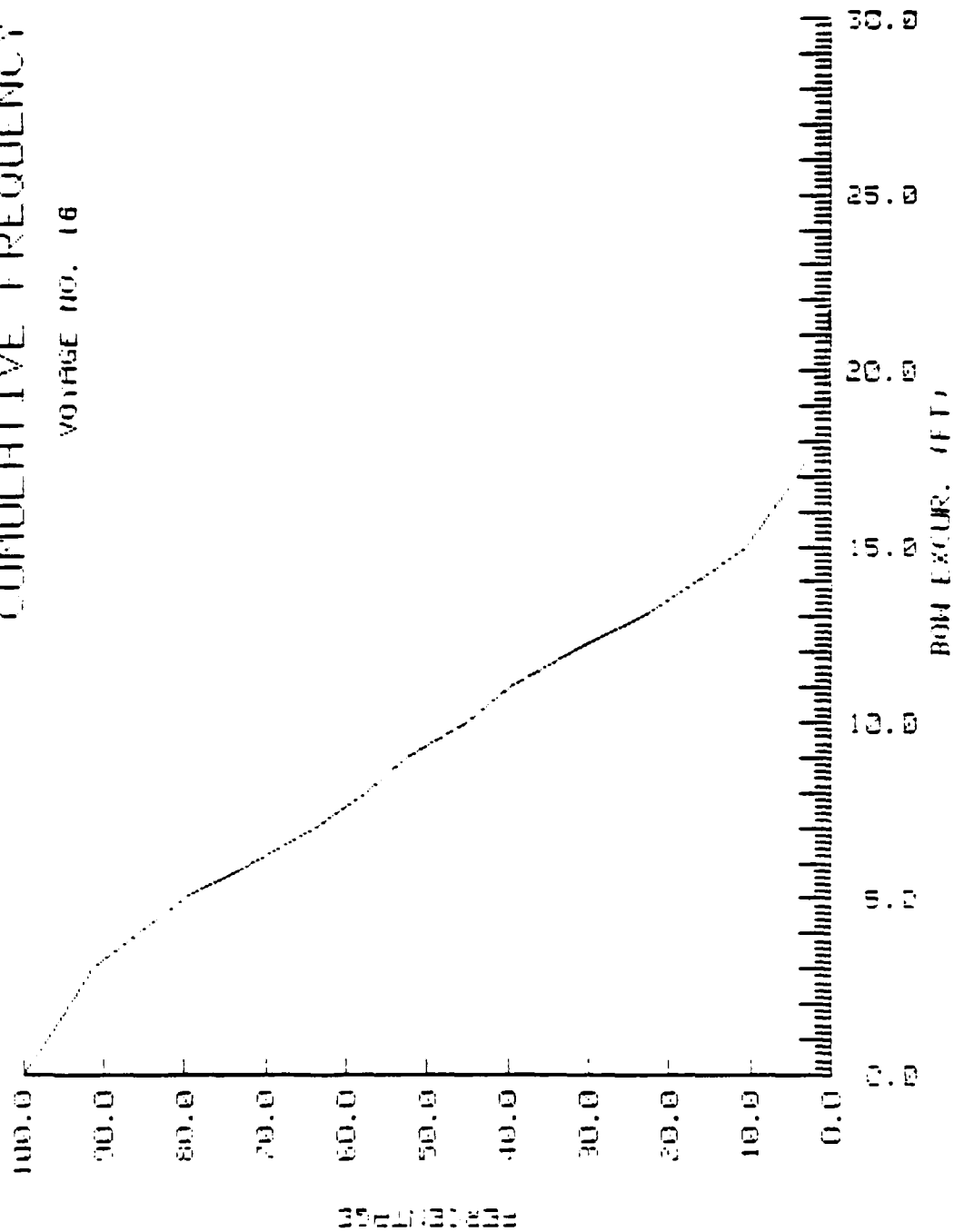
VOLUME NO. 16





# CUMULATIVE FREQUENCY

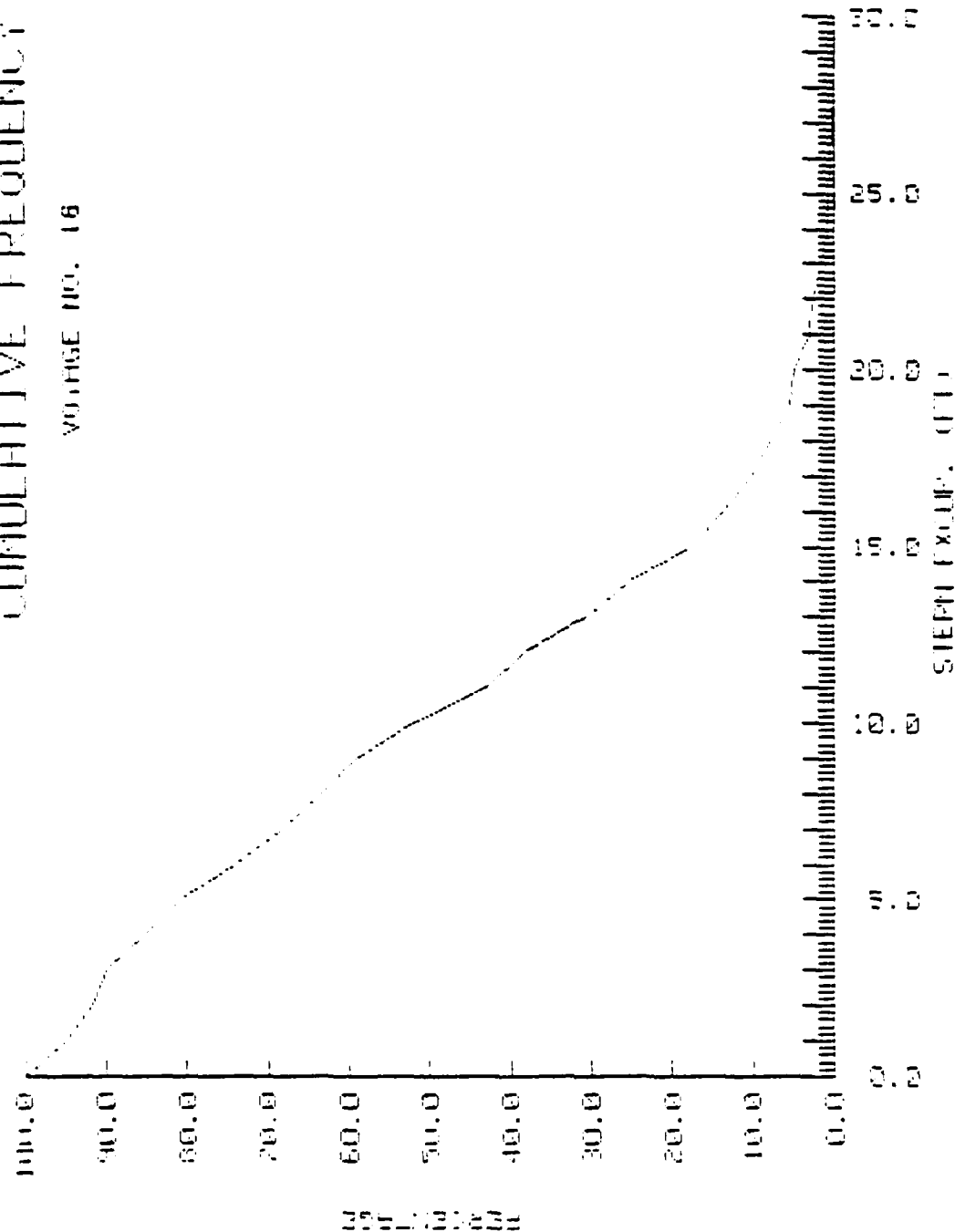
VOLAGE NO. 16





# CUMULATIVE FREQUENCY

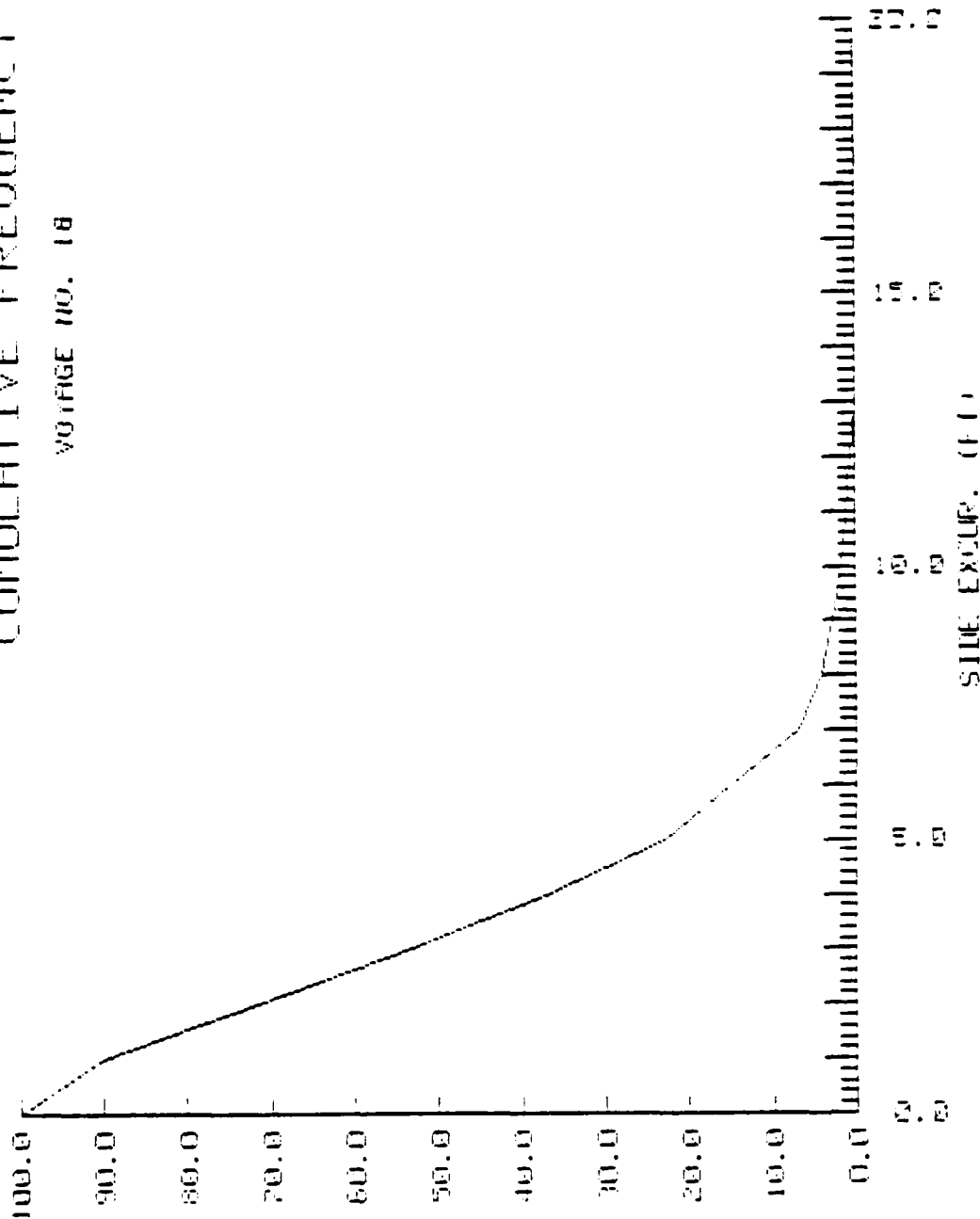
VOLUME NO. 18





# CUMULATIVE FREQUENCY

VOLTAGE NO. 18



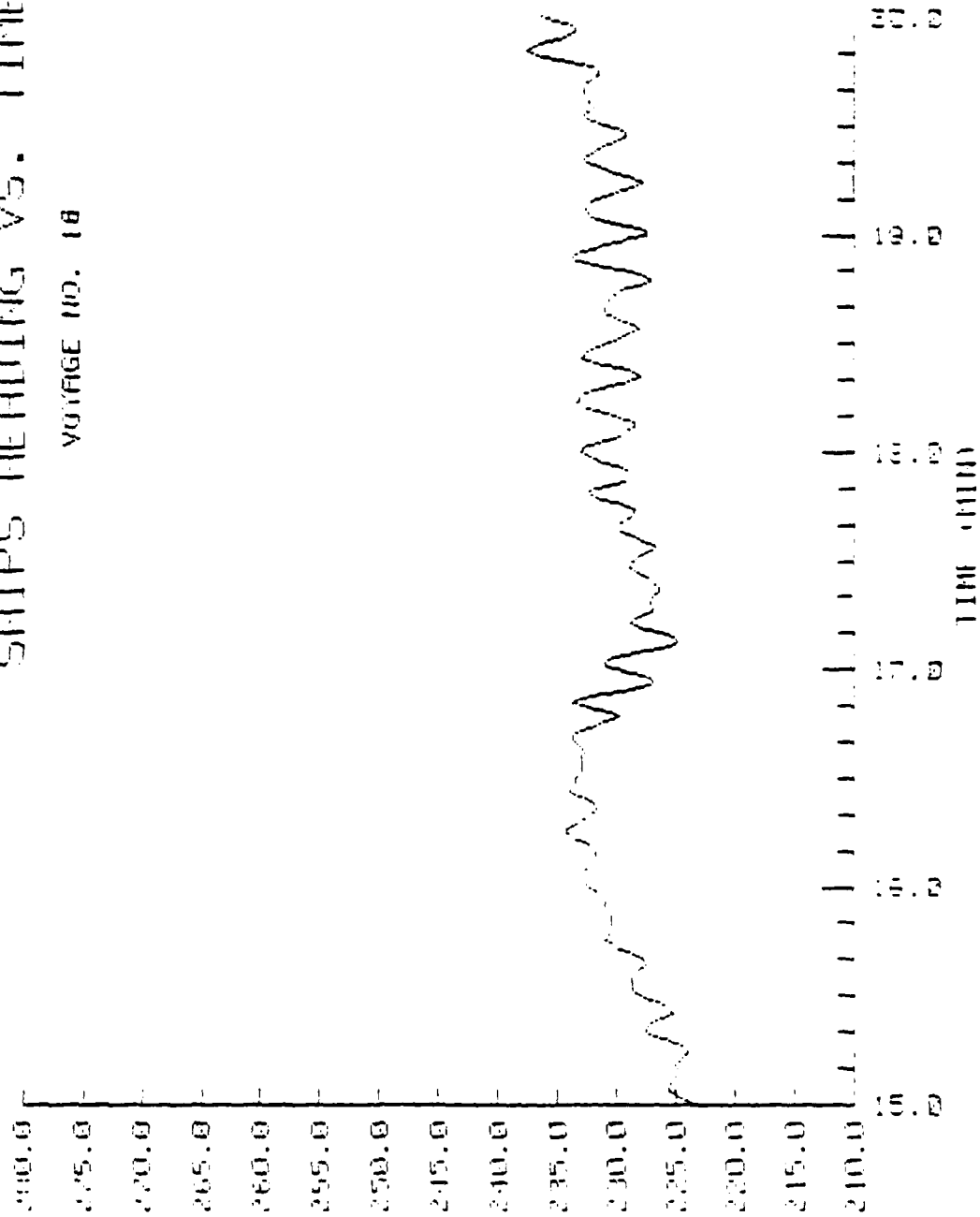
100.0  
90.0  
80.0  
70.0  
60.0  
50.0  
40.0  
30.0  
20.0  
10.0  
0.0

SIDE EXCUR. (FT)



# SHIPS HEADING VS. TIME

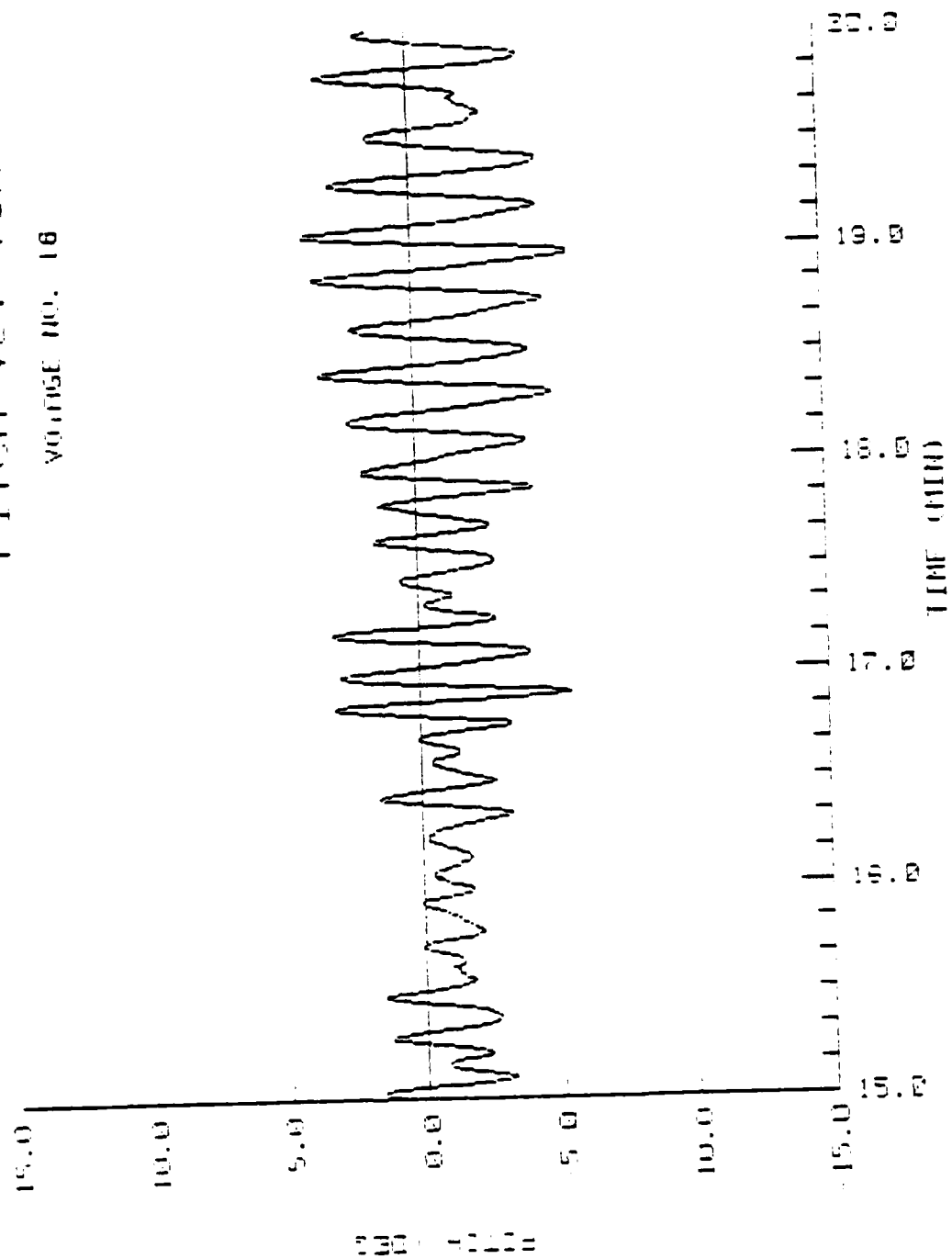
VOLUME NO. 18





# PITCH VS. TIME

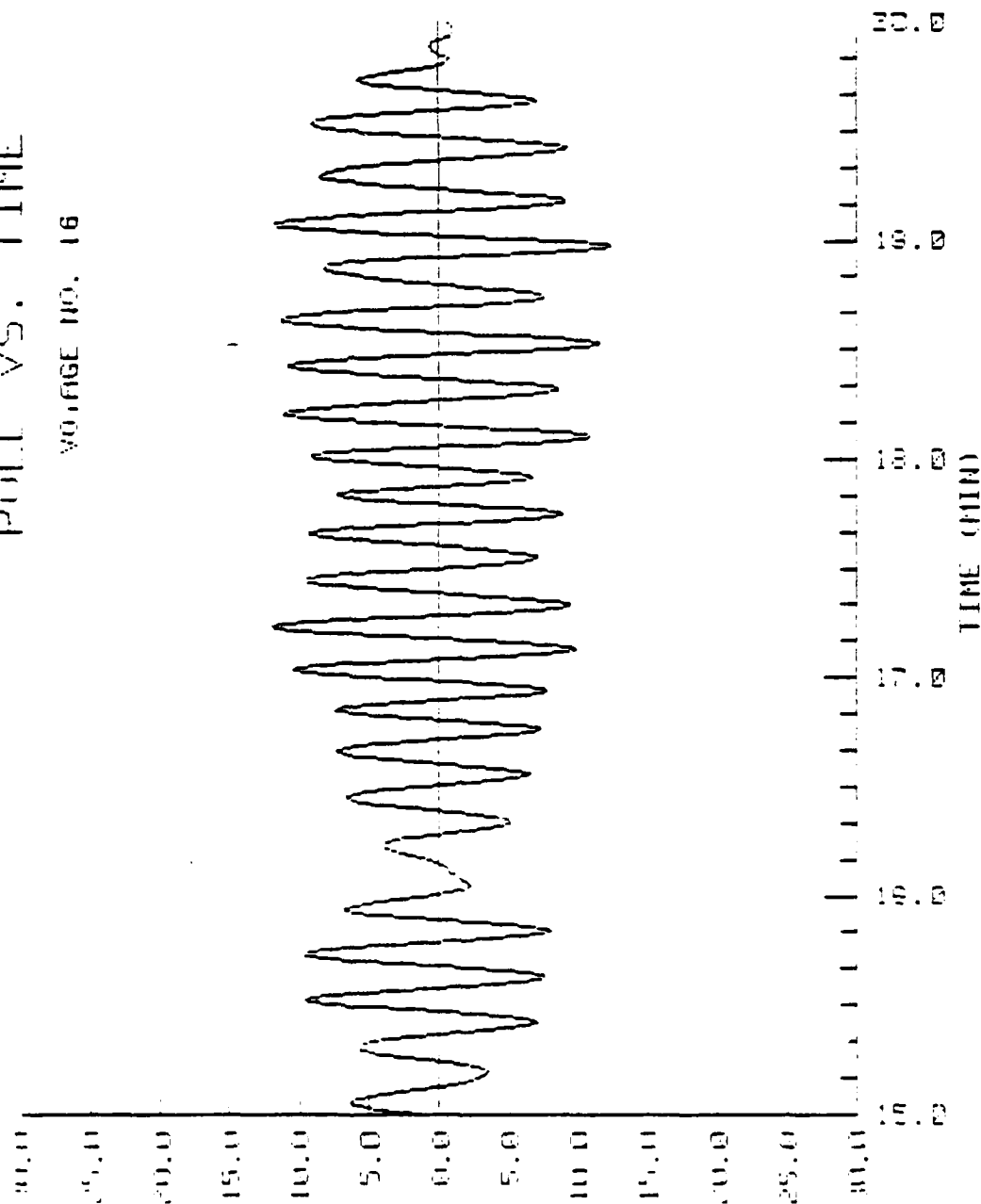
VOLUME NO. 16





POLL VS. TIME

VOLUME NO. 16

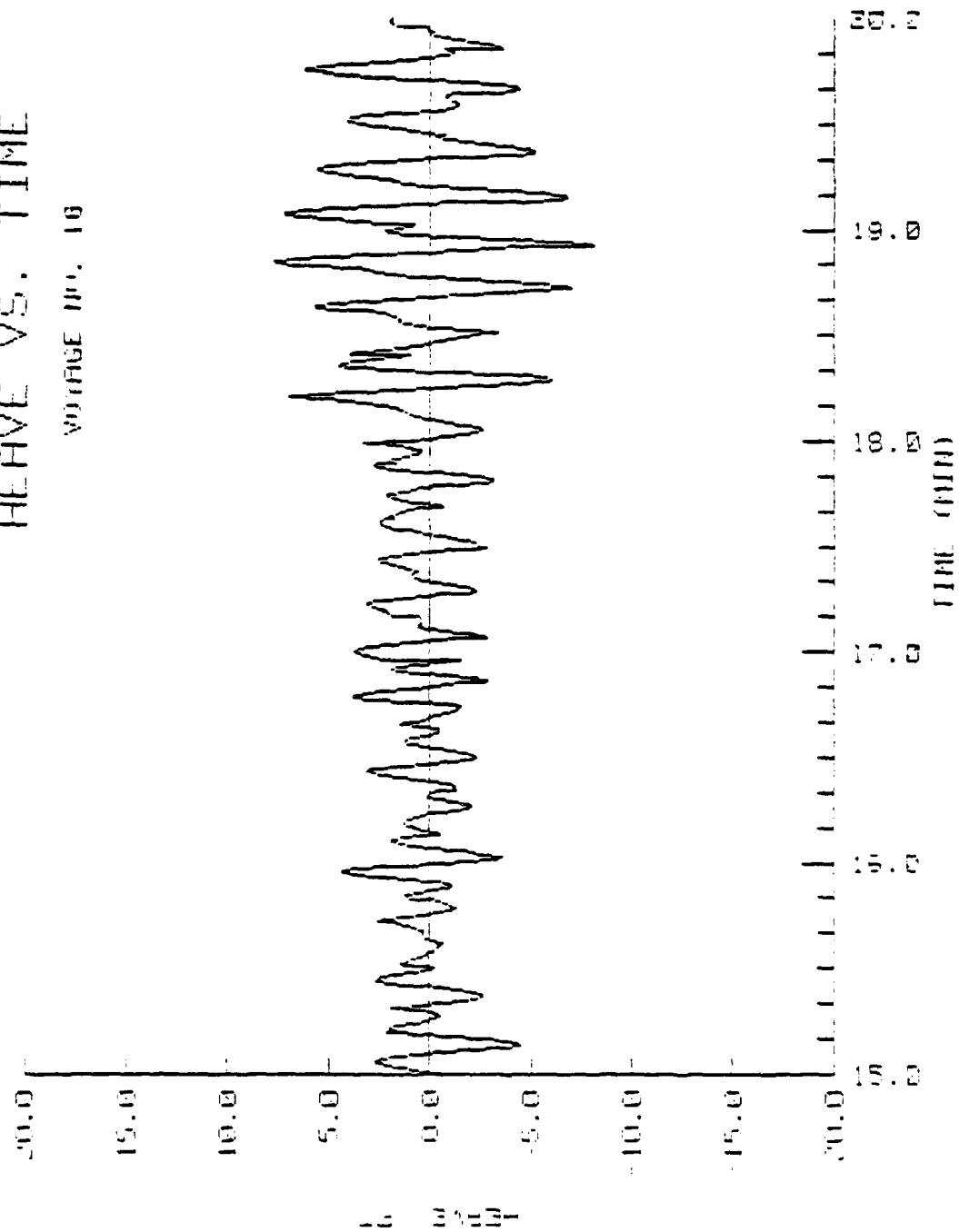


130-7705



# HEAVE VS. TIME

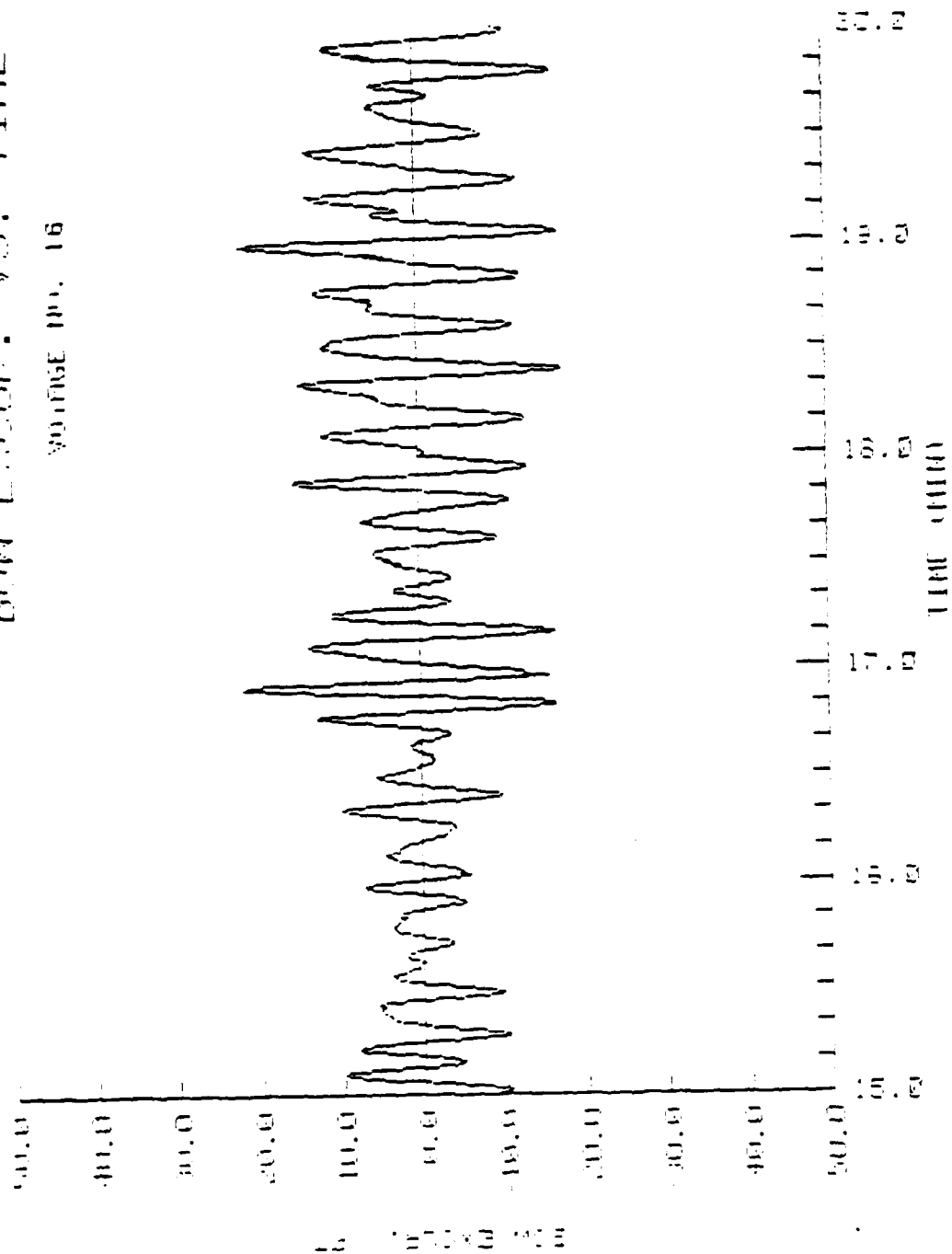
VOLTAGE NO. 16





# IRON EQUIL. VS. TIME

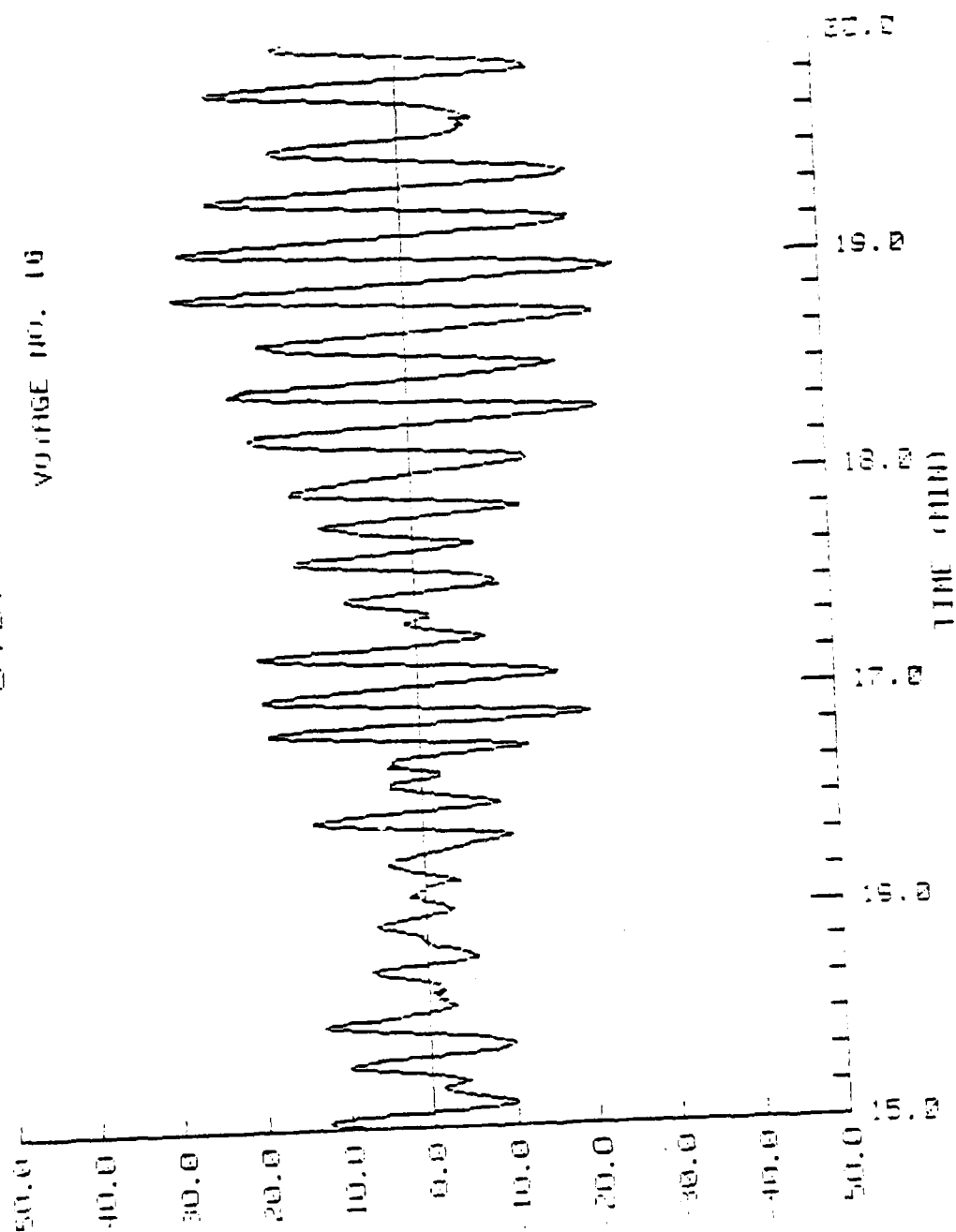
VOLUME NO. 16





STEPHEN EXCUR. VS. TIM

YOU RISE UP. 10





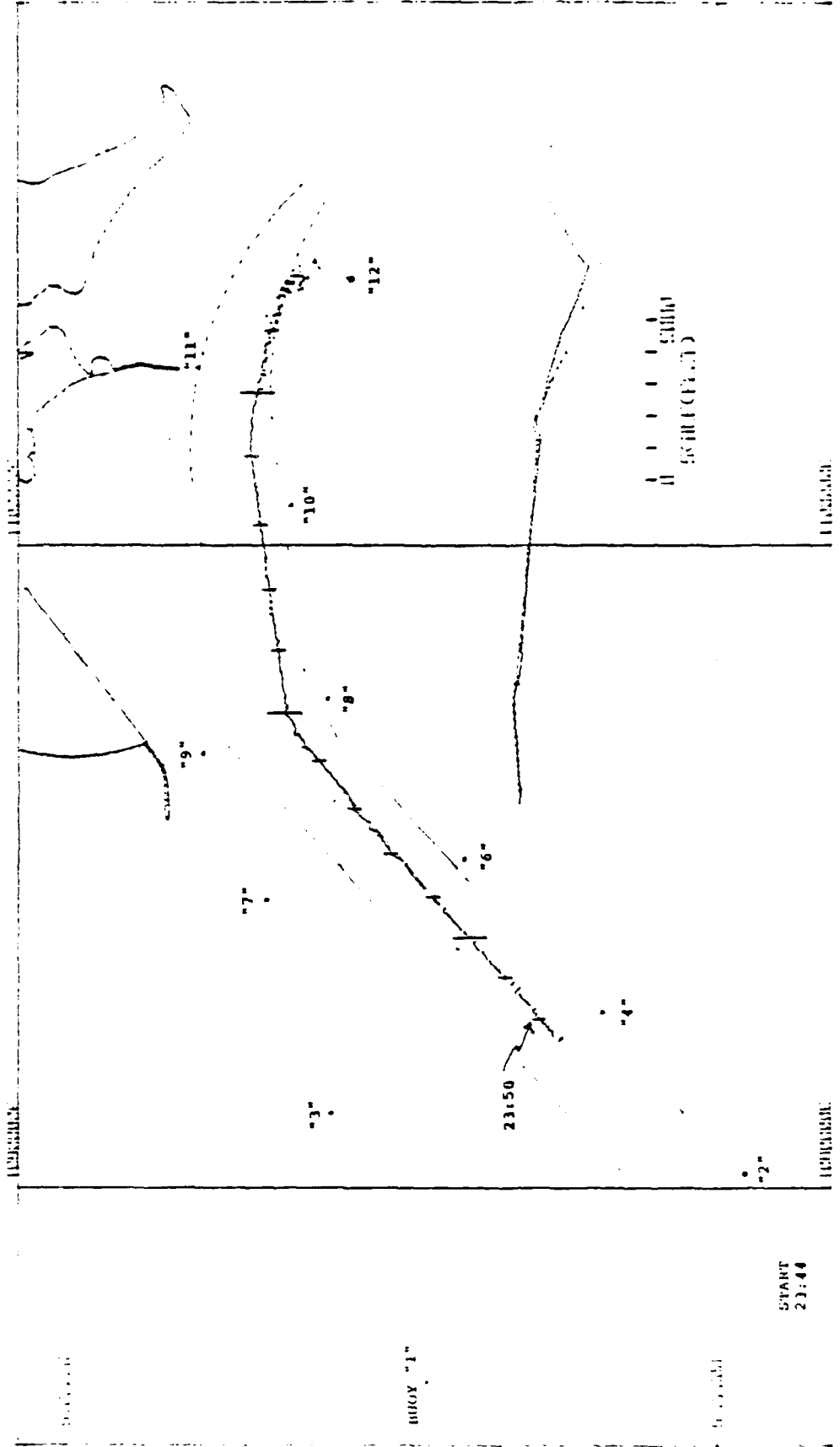
# STATISTICAL SUMMARY

VOYAGE NO. 17

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
ROLL (DEG.)	-.1	.6	.3	.3
PITCH (DEG.)	.8	1.9	.8	.9
ROLL (FT. SEC. SEC.)	.0	3.6	1.1	1.2
PITCH (FT.)	.0	2.5	.8	.9
ROLL (FOUR. (FT.)	.0	4.6	1.5	1.8
PITCH (FOUR. (FT.)	.0	2.7	1.1	1.2
ROLL (FOUR. (FT.)	.0	3.0	1.0	1.2



Recorded III. 17 0000 10000  
 1000 10000

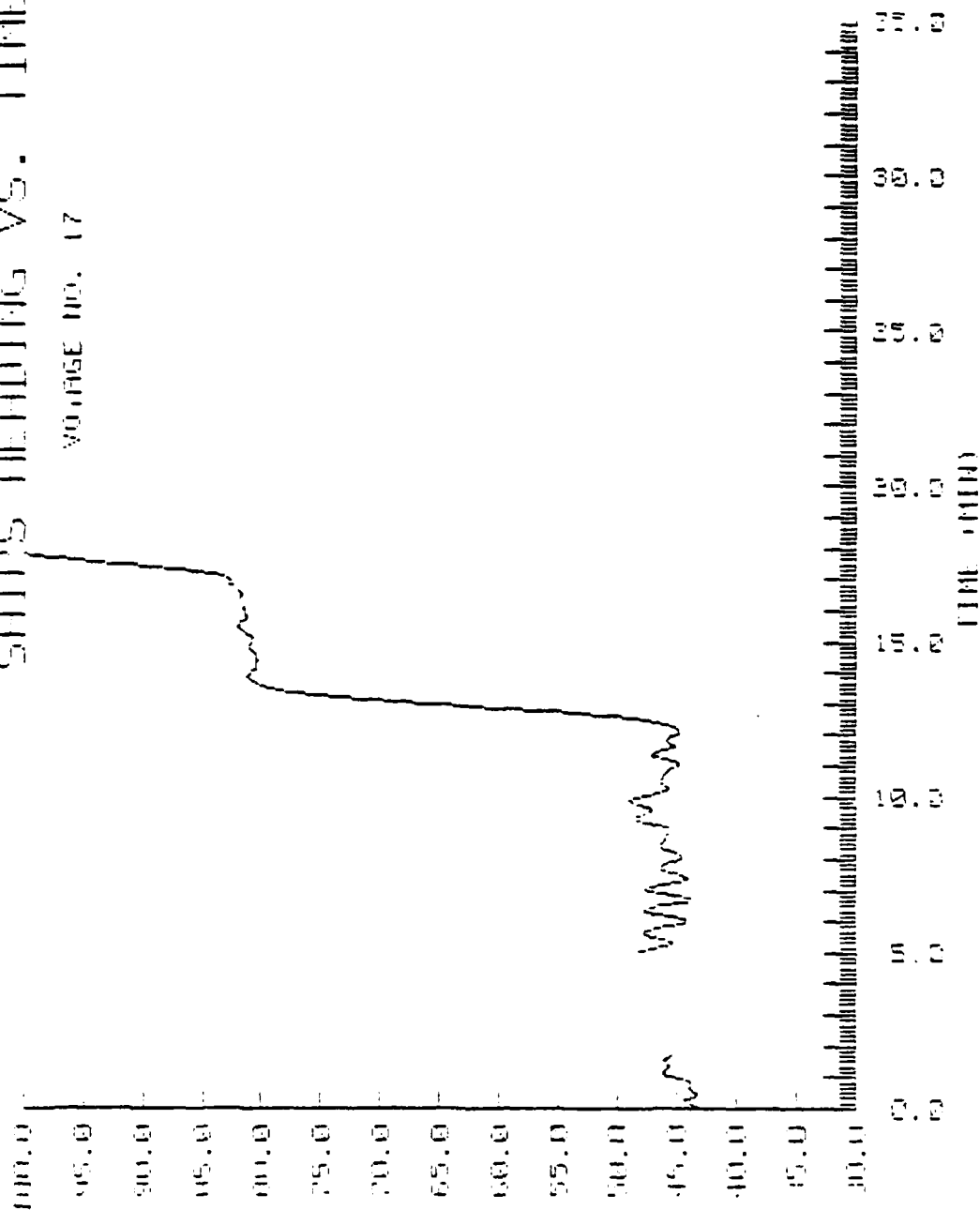


START  
 23:44



# SHIPS HEADING VS. TIME

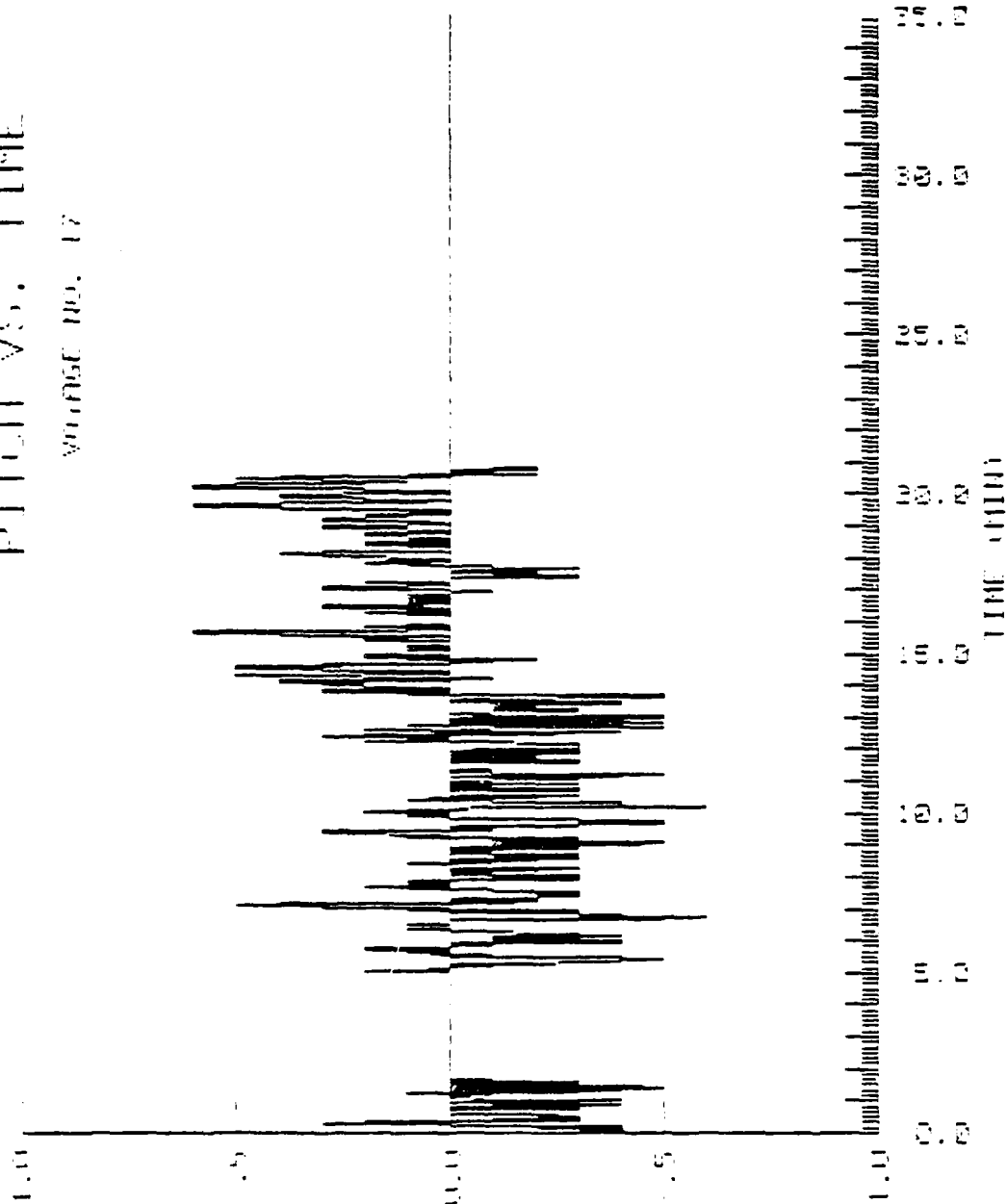
VOYAGE NO. 17



00.0 05.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 45.0 50.0 55.0 60.0 65.0 70.0 75.0 80.0 85.0 90.0 95.0 100.0



# PITCH VS. TIME TRACE NO. 17

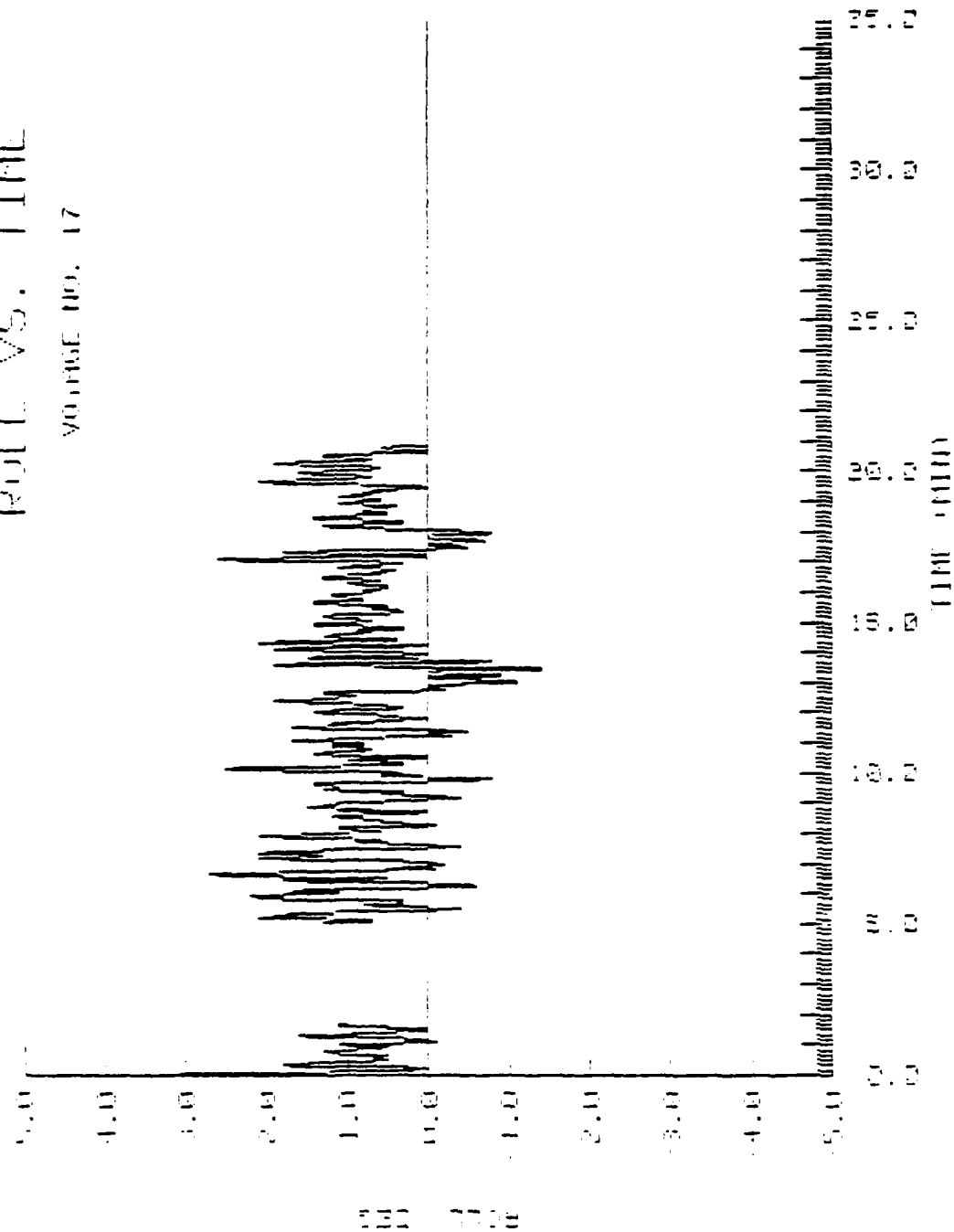


0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70 0.75 0.80 0.85 0.90 0.95 1.00



# ROLL VS. TIME

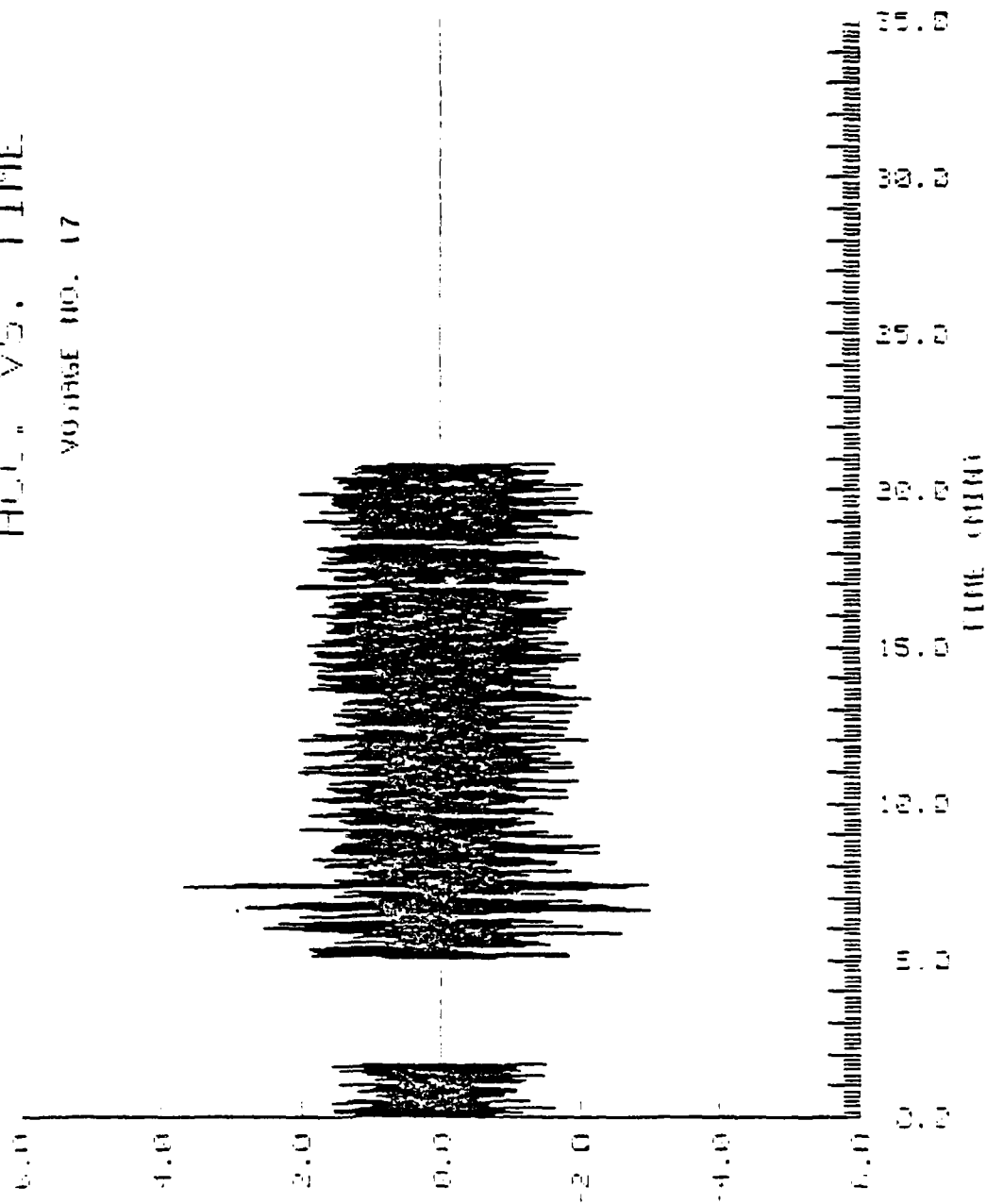
## VOLUME NO. 17





HCC VS. TIME

VOLUME NO. 17

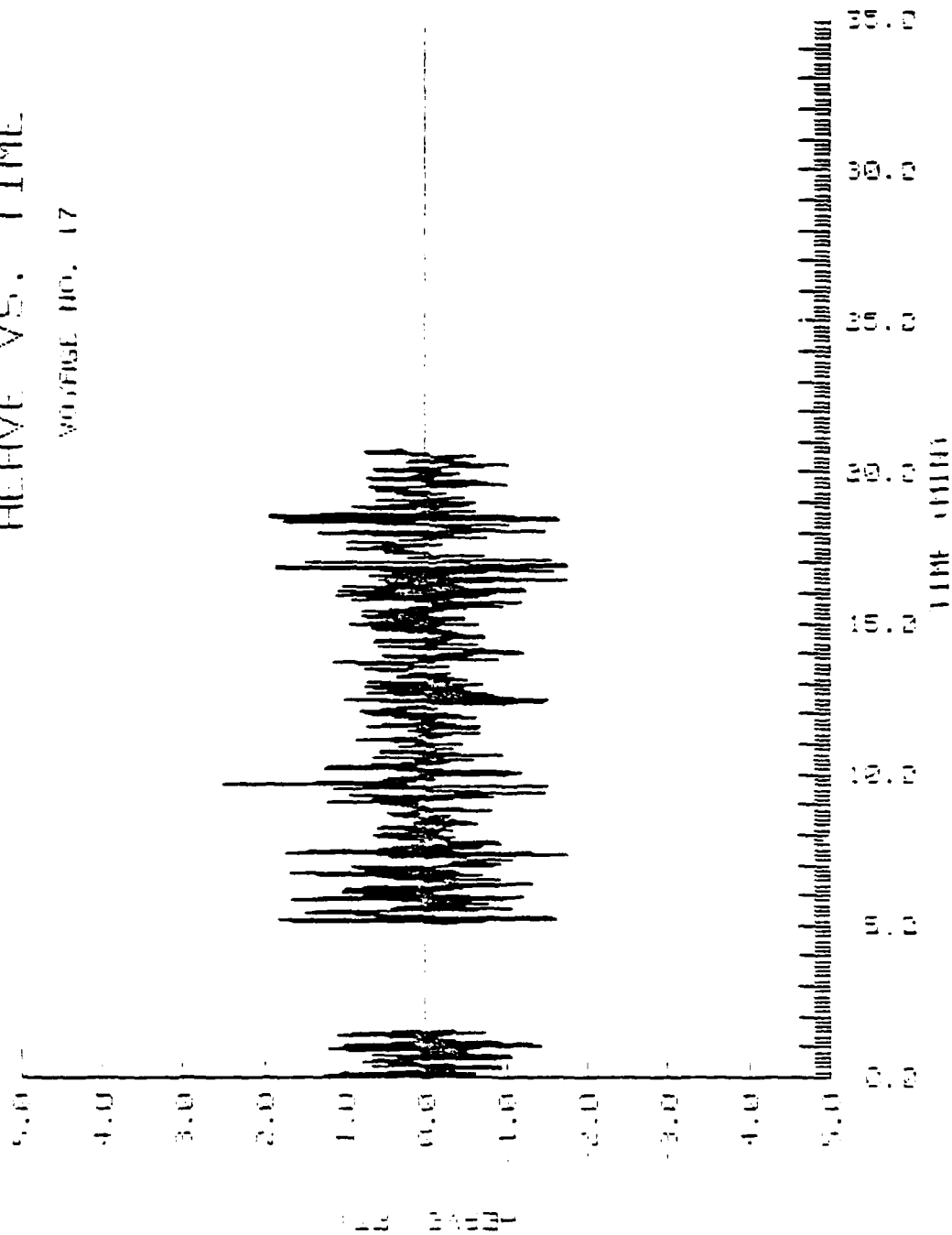


100 100 100 100



# HEAVE VS. TIME

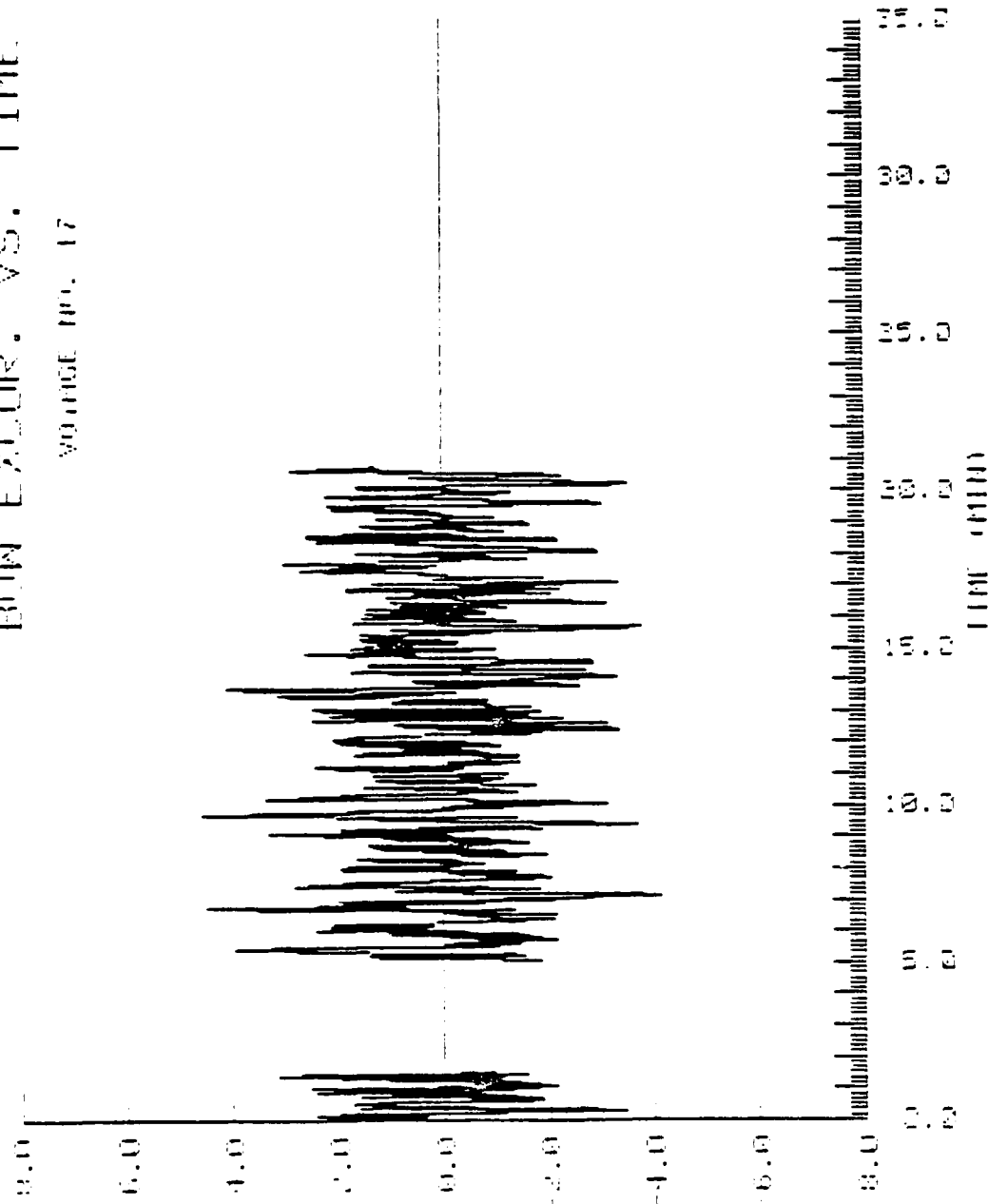
WAVE NO. 17





# BOW EXCUR. VS. TIME

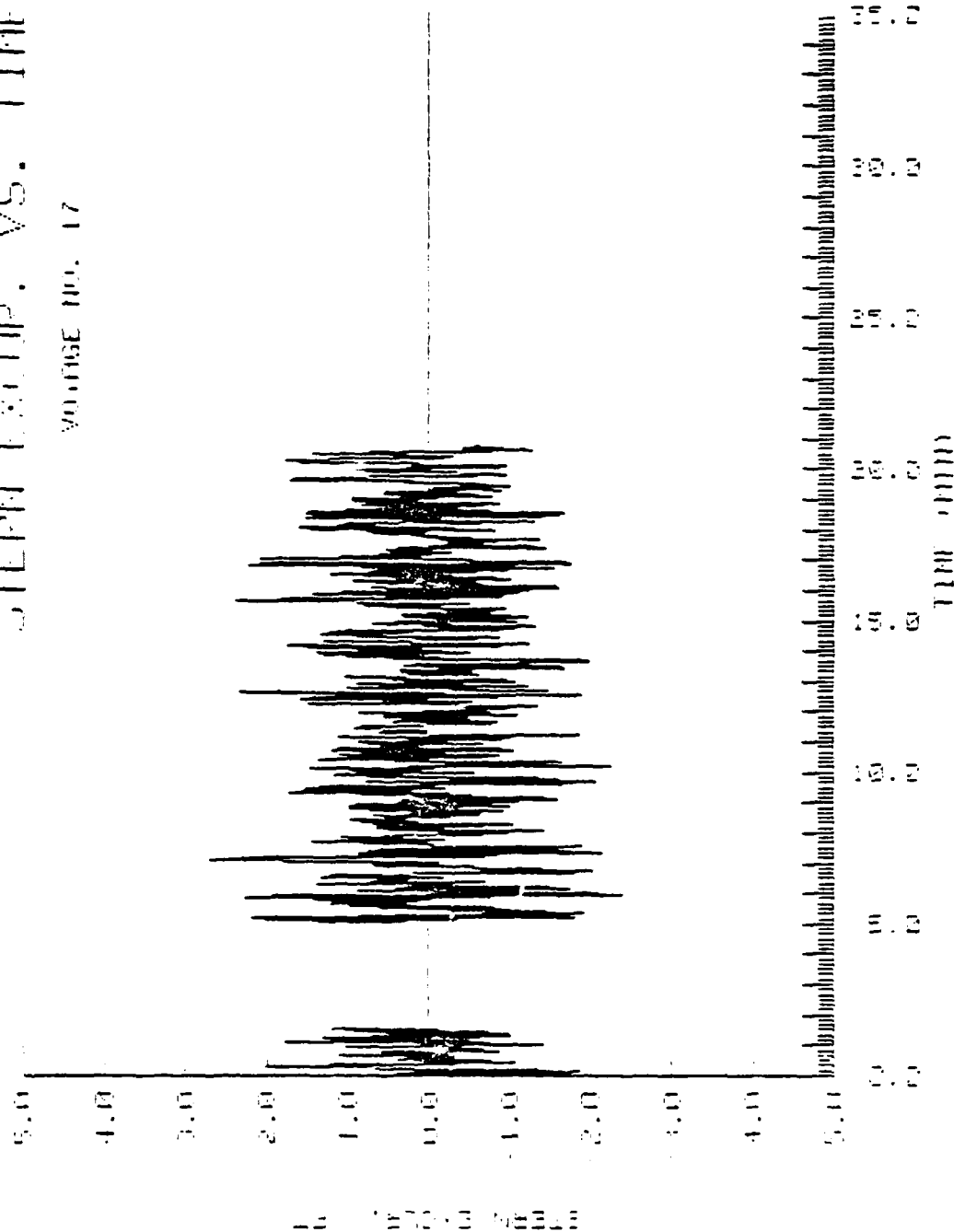
VOYAGE NO. 17





# STEPH EXCURP. VS. TIME

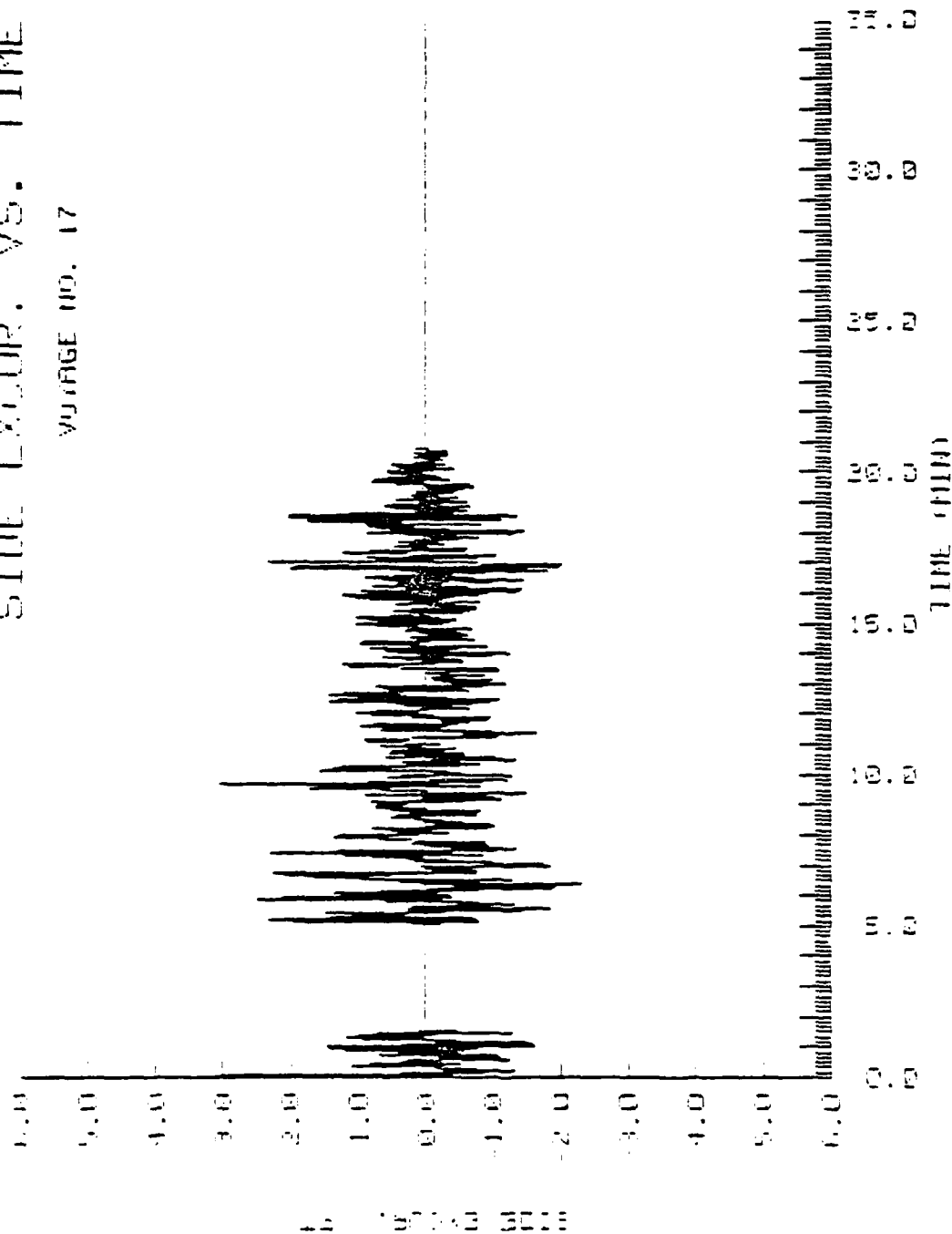
## VOLUME NO. 17





# SIDE EXCUR. VS. TIME

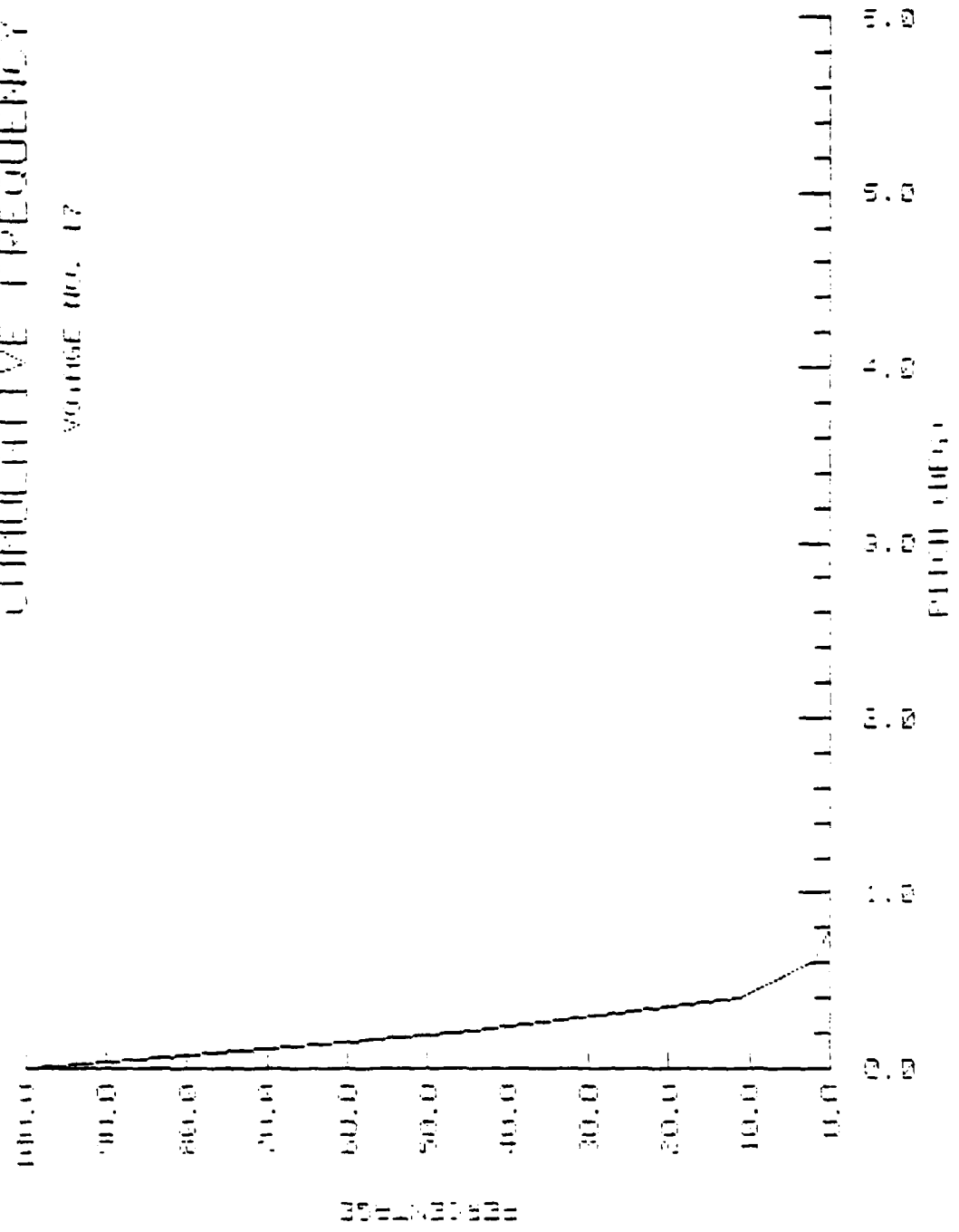
WUJAGE NO. 17





# CUMULATIVE FREQUENCY

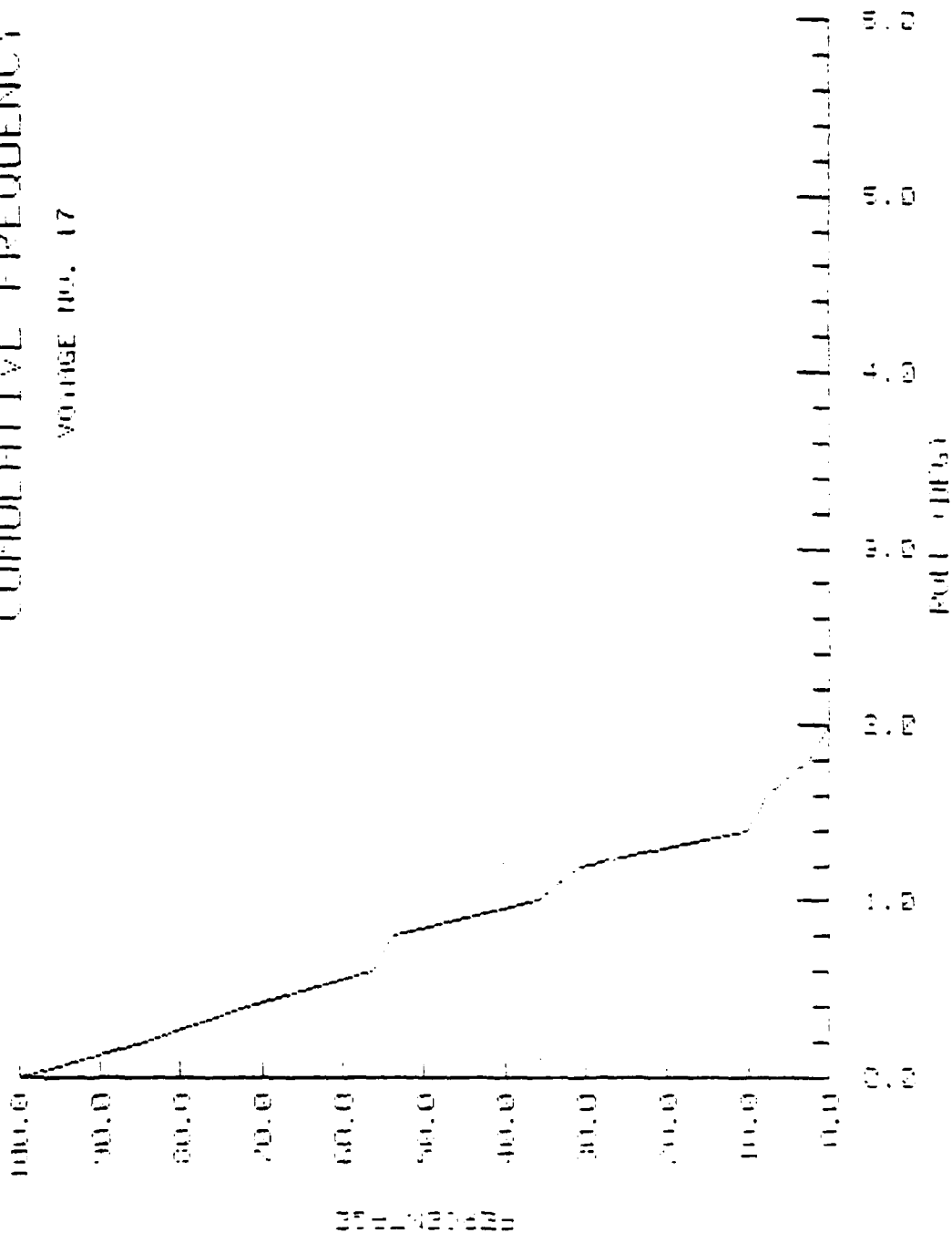
W006E 000. 17





# CUMULATIVE FREQUENCY

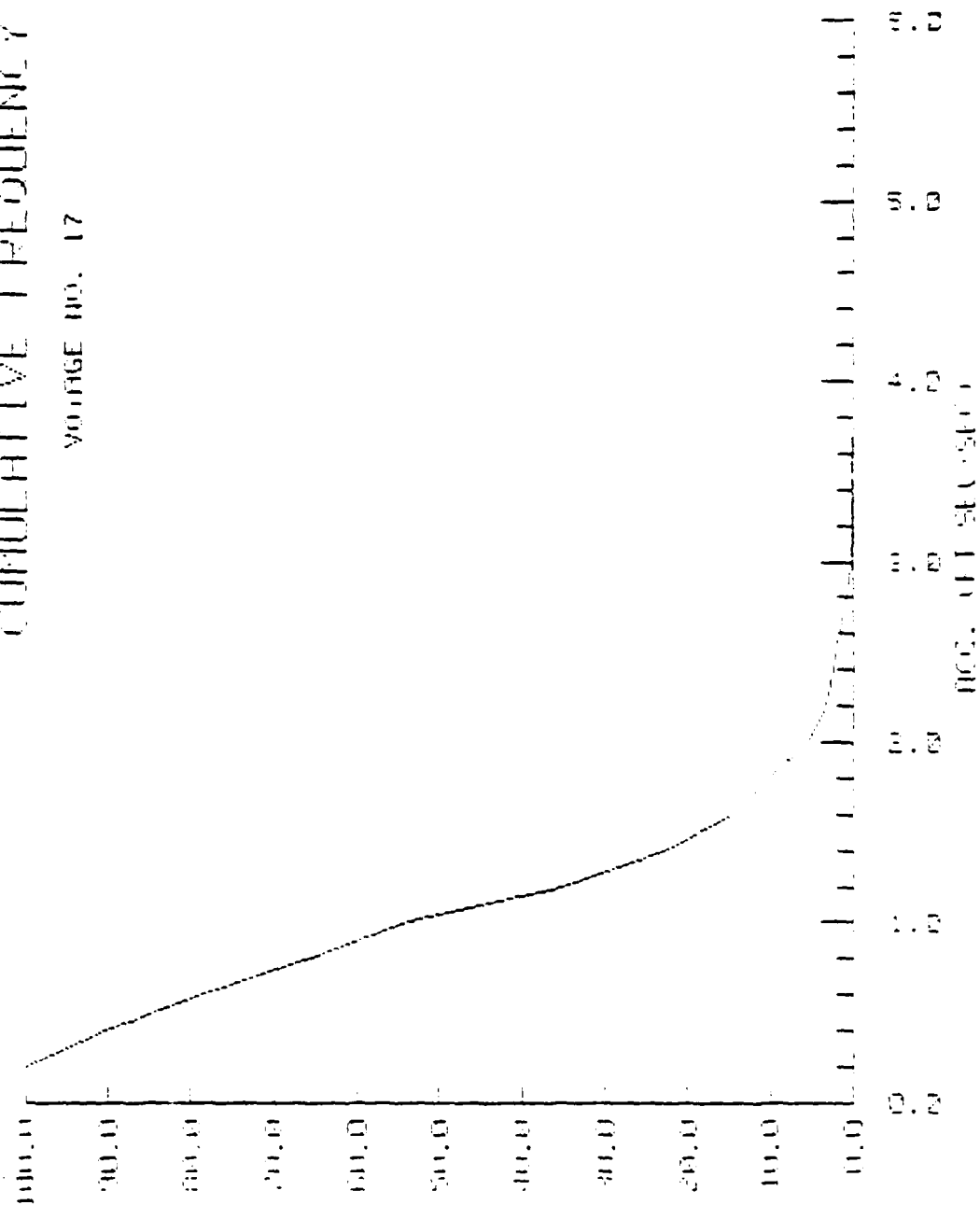
VOLUME NO. 17





# CUMULATIVE FREQUENCY

YOUNGE NO. 17



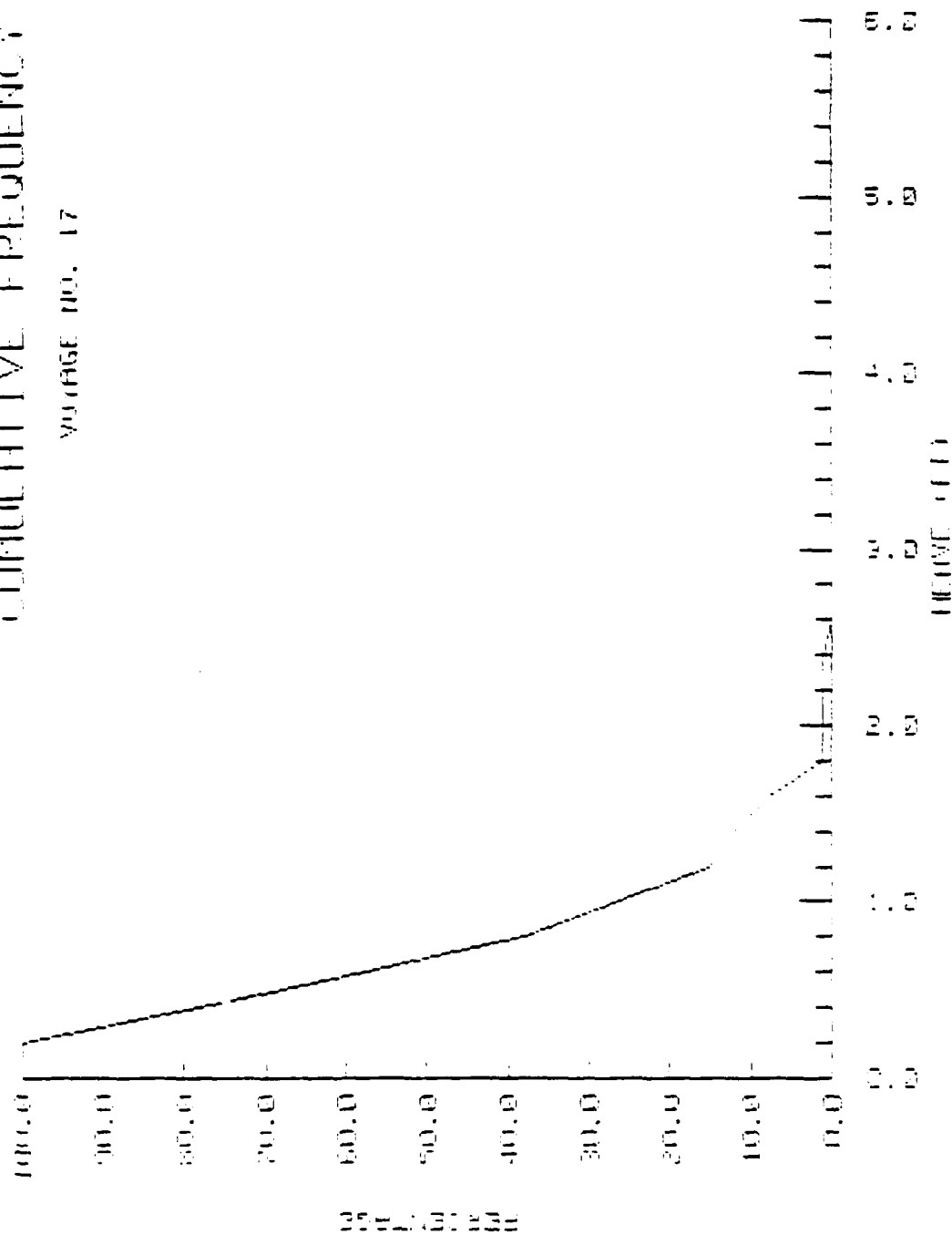
PERCENT

NO. OF STATIONS



# CUMULATIVE FREQUENCY

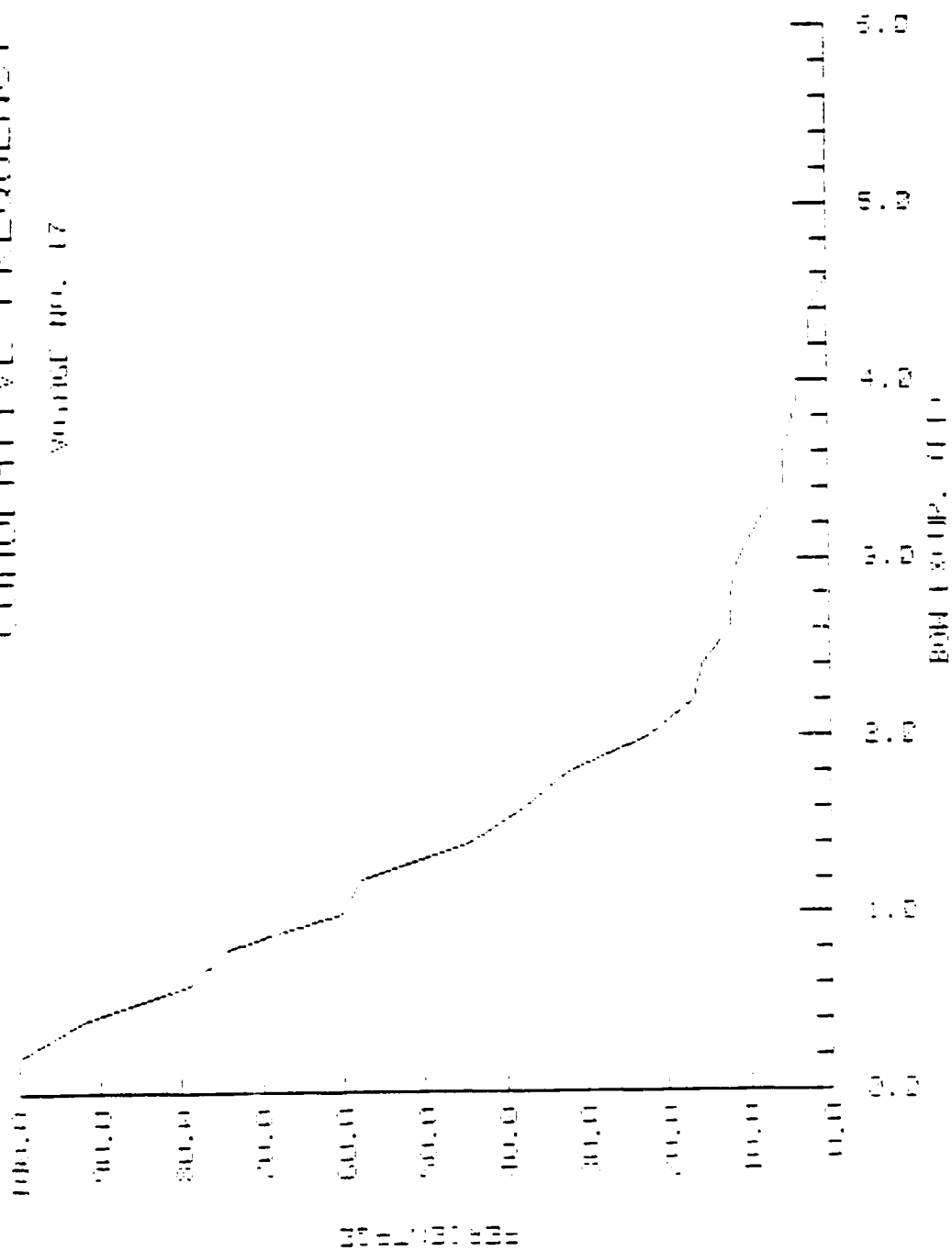
VOYAGE NO. 17





# CUMULATIVE FREQUENCY

## YOUNG NO. 17





AD-A098 984

TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

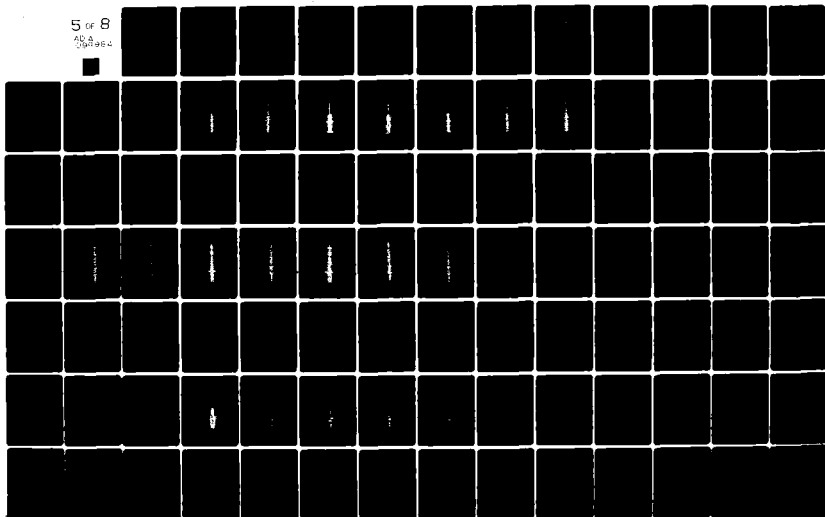
UNCLASSIFIED

TETRA-TC-3925-APP-A(1)

NL

5 of 8

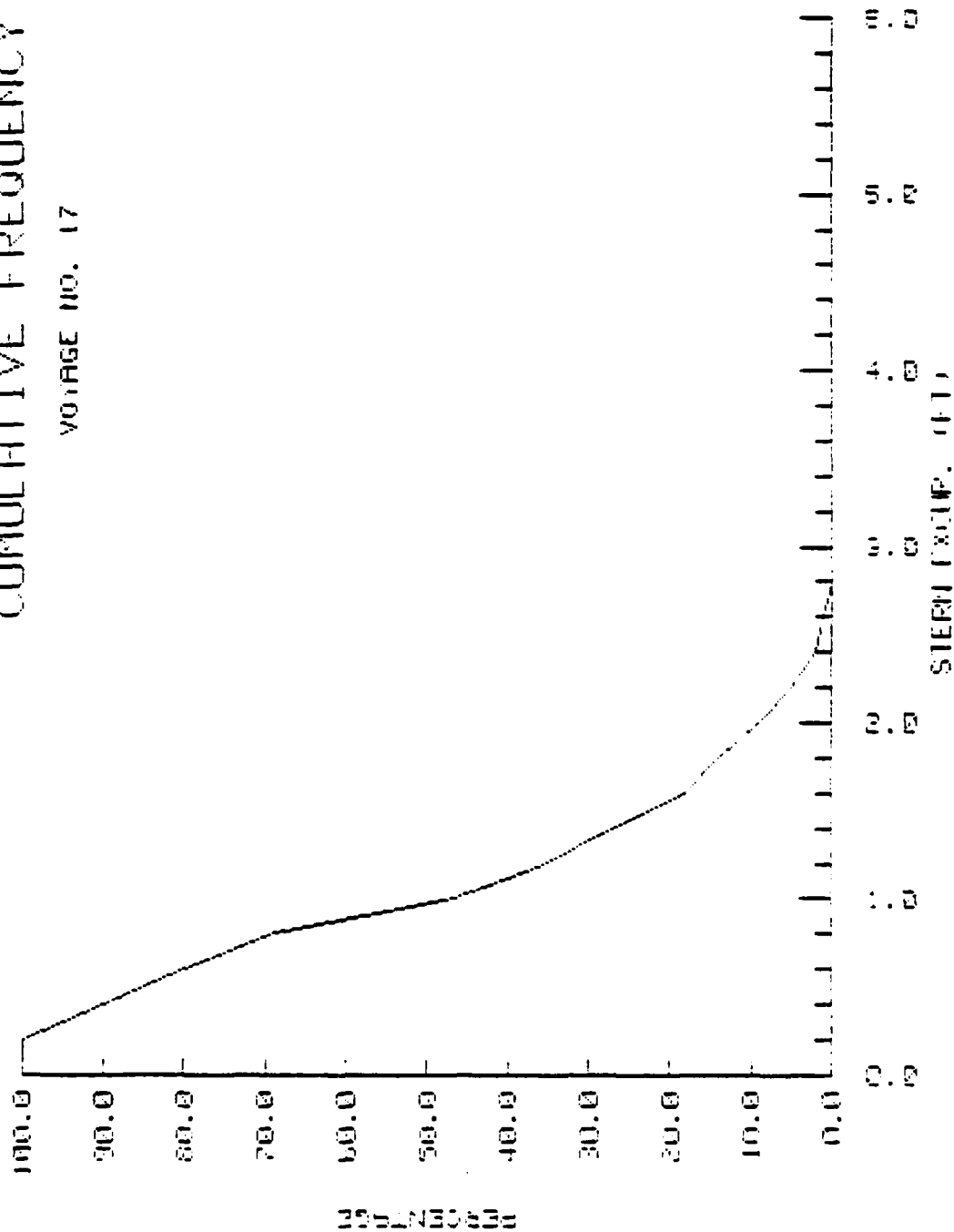
AD-A098 984





# CUMULATIVE FREQUENCY

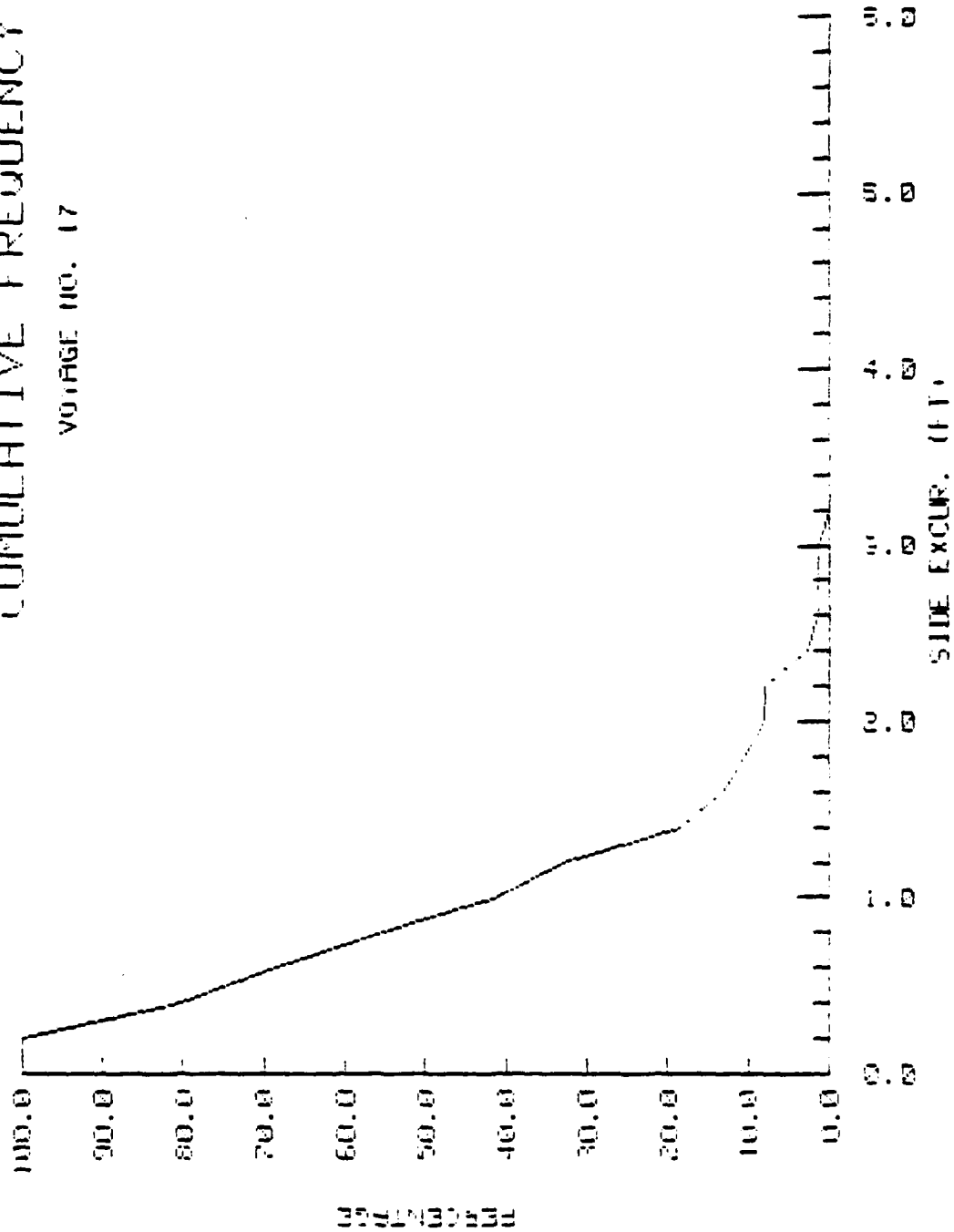
VOLAGE NO. 17





# CUMULATIVE FREQUENCY

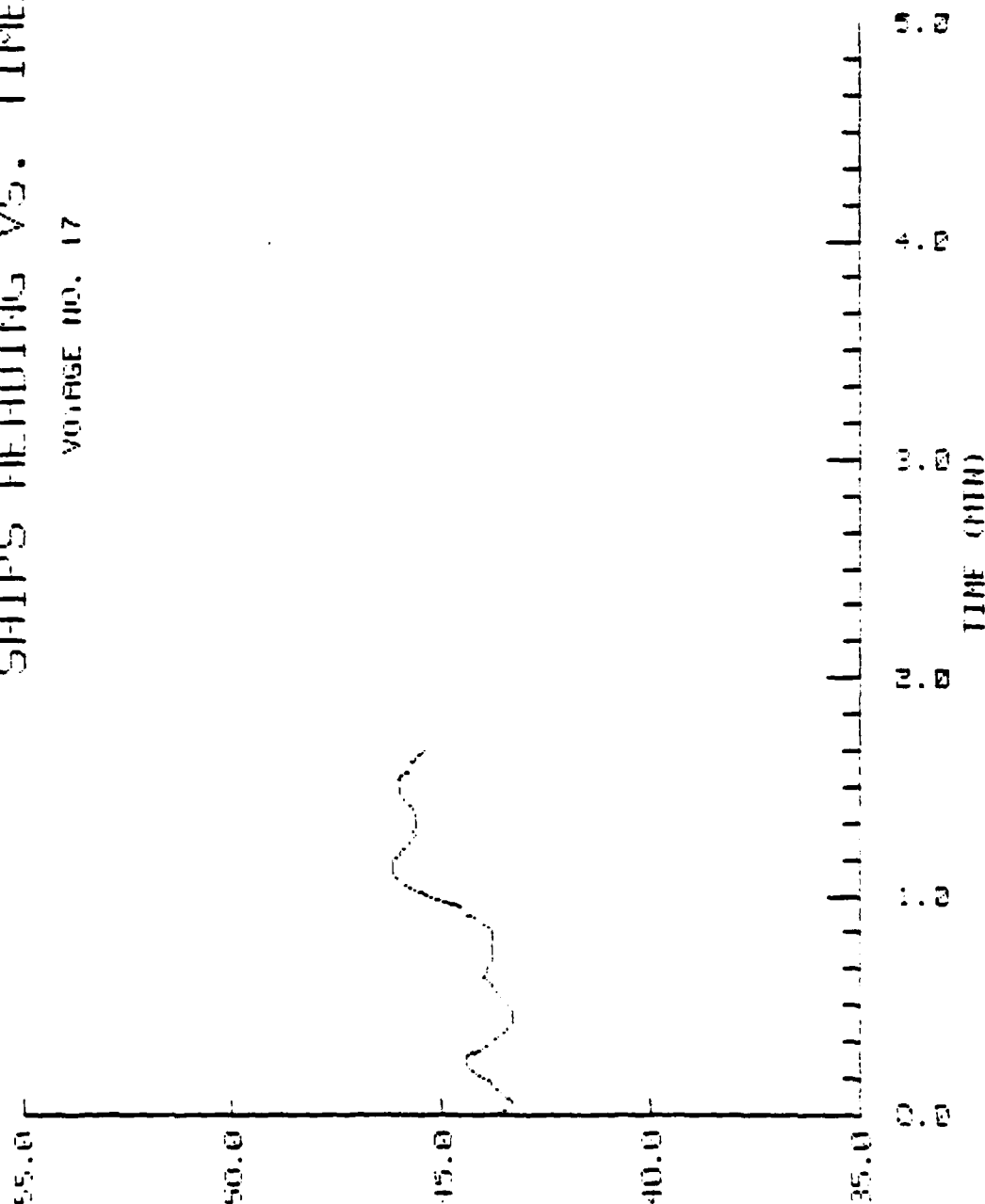
VOLUME NO. 17





# SHIPS HEADING VS. TIME

VOYAGE NO. 17

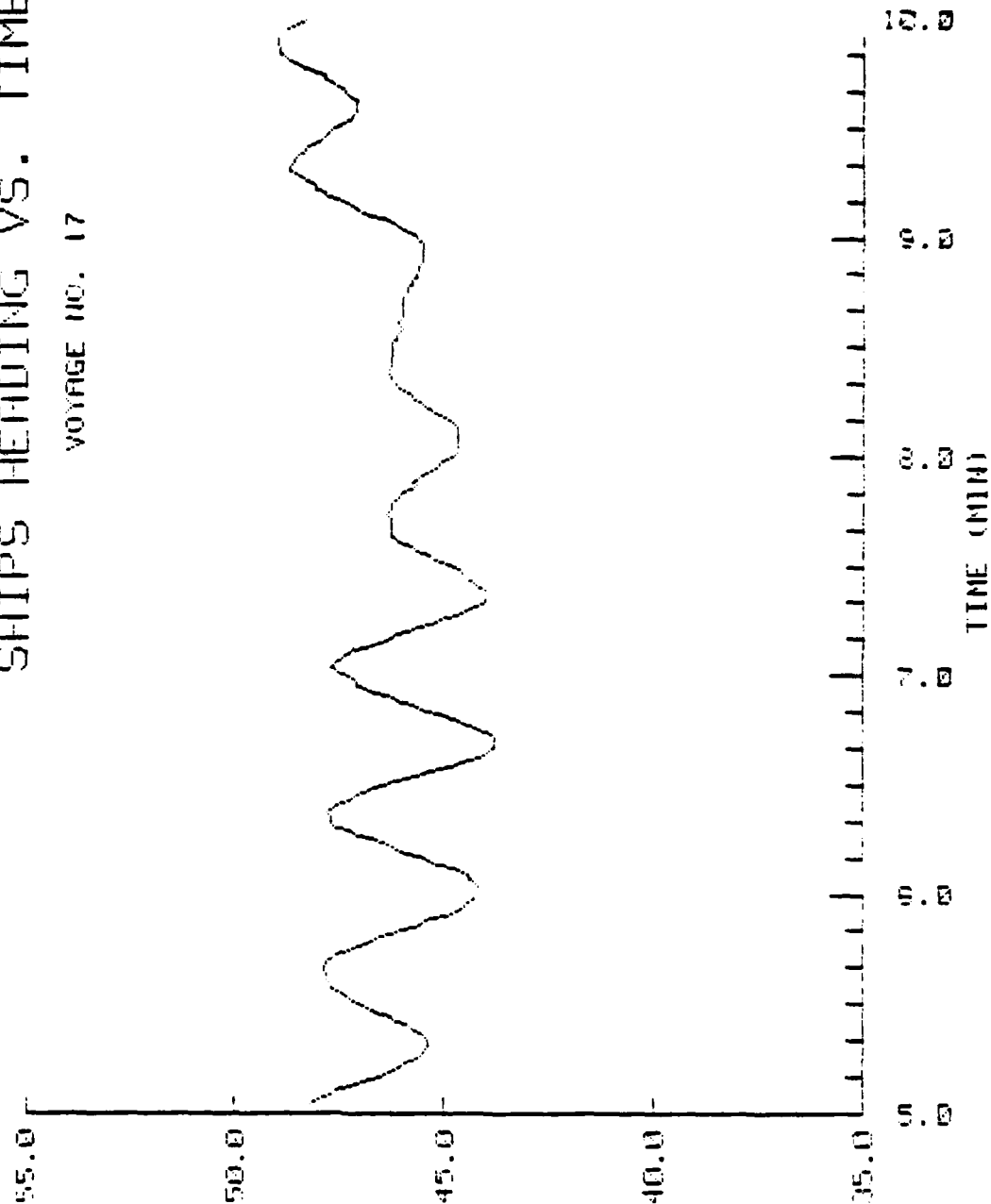


100 200 300 400 500 600 700 800 900 1000



# SHIPS HEADING VS. TIME

VOYAGE NO. 17

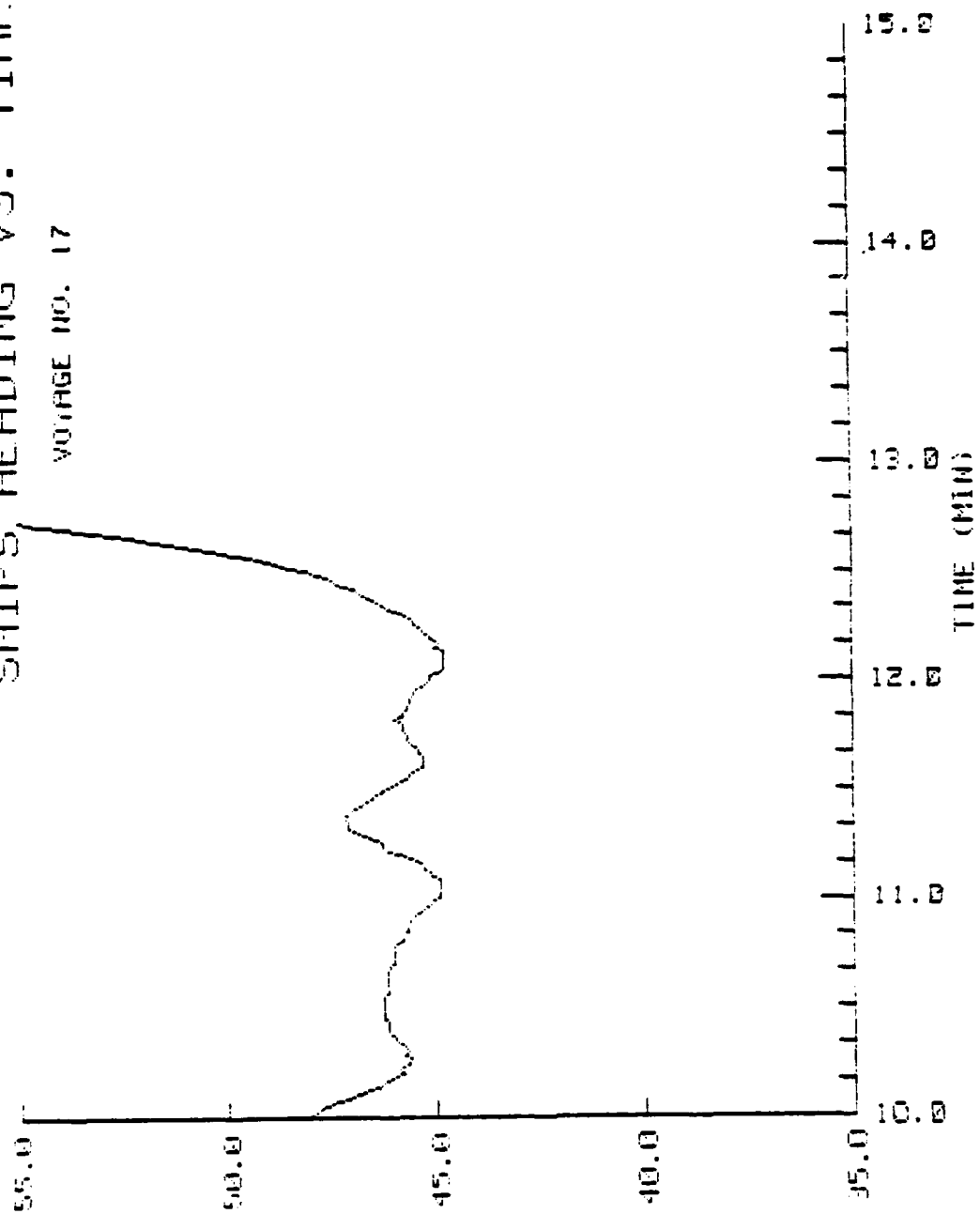


55.0 50.0 45.0 40.0 35.0

12.0 9.0 6.0 3.0 0.0



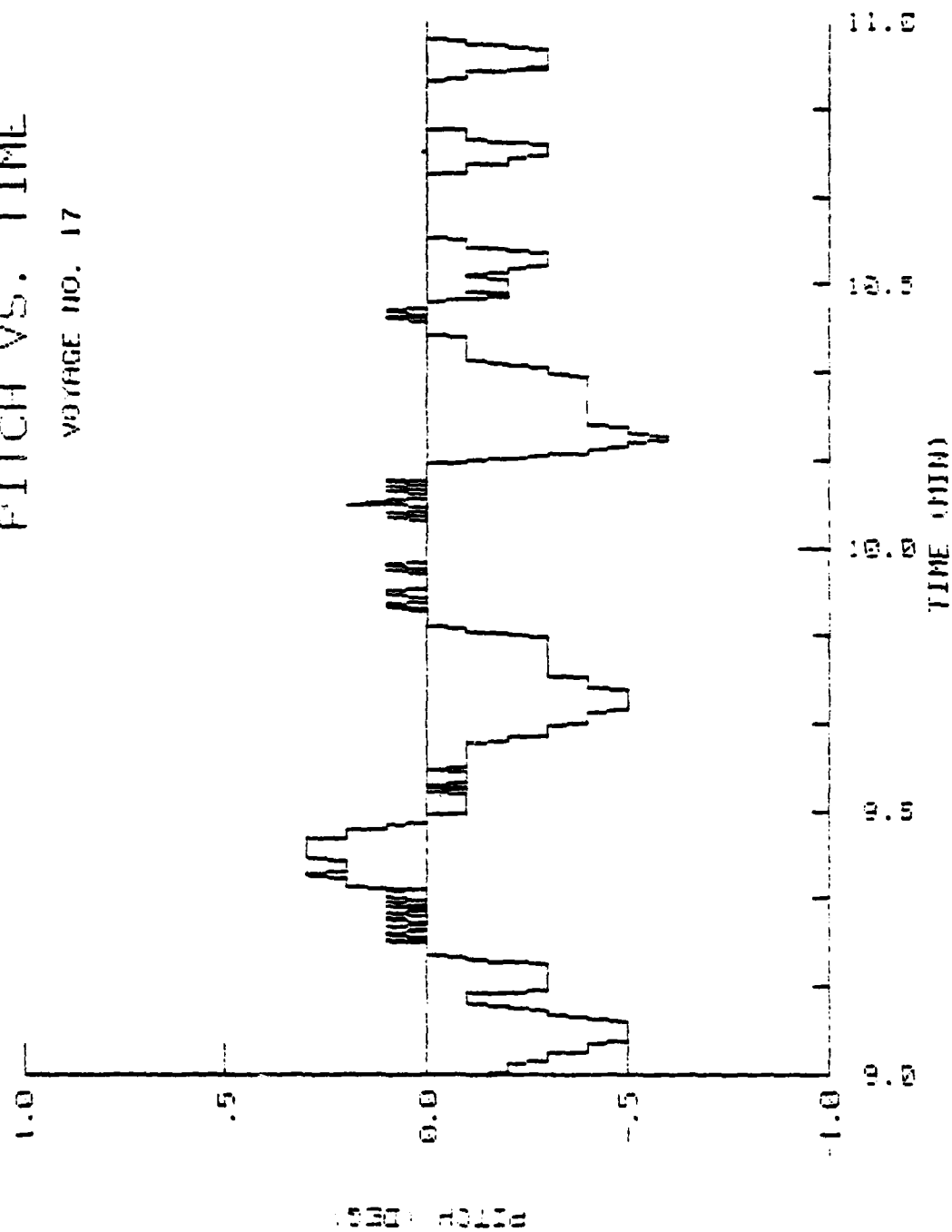
VOYAGE NO. 17



**0000 UNCLAS SECRET**



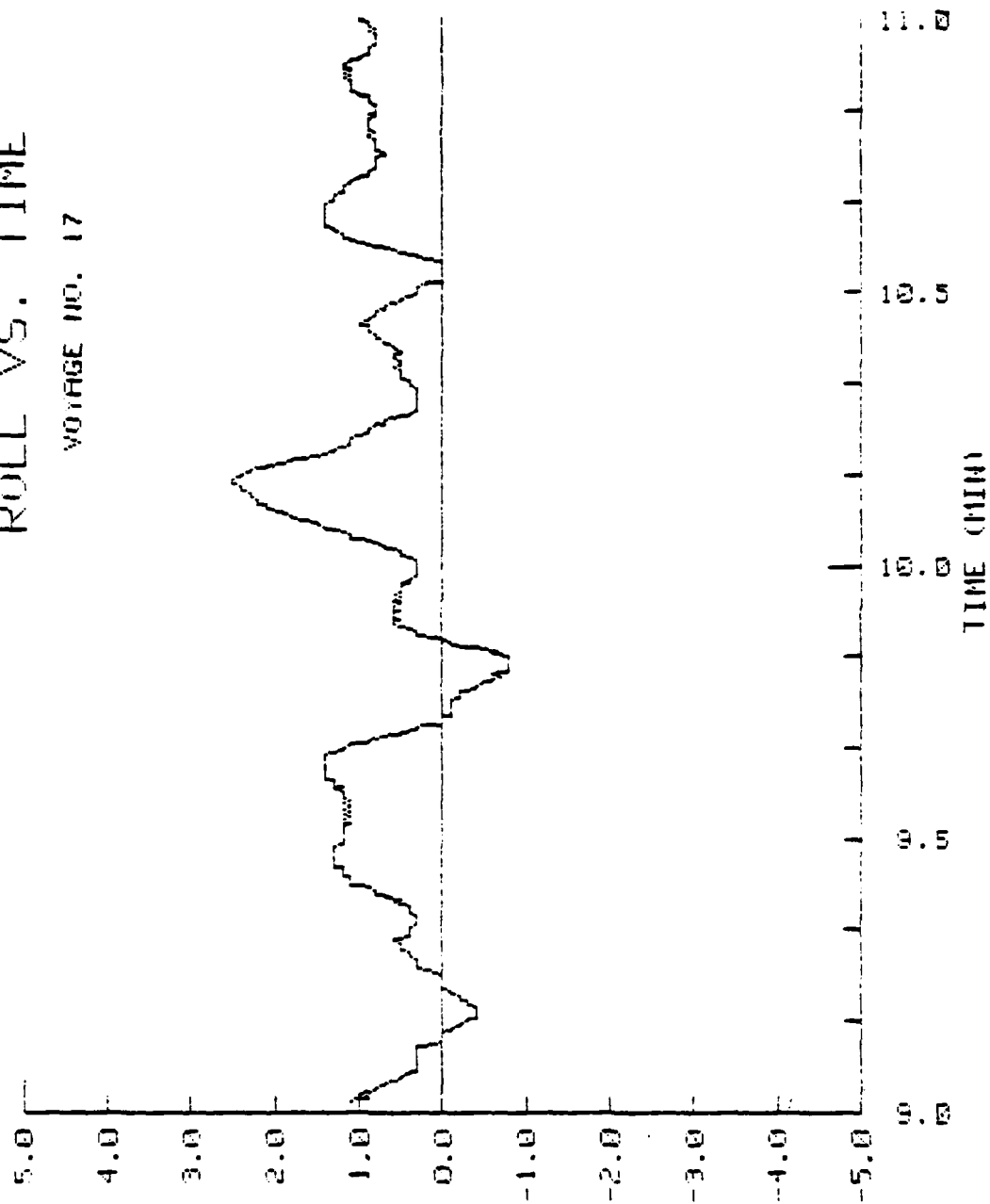
# PITCH VS. TIME VOYAGE NO. 17





# ROLL VS. TIME

VOTAGE NO. 17

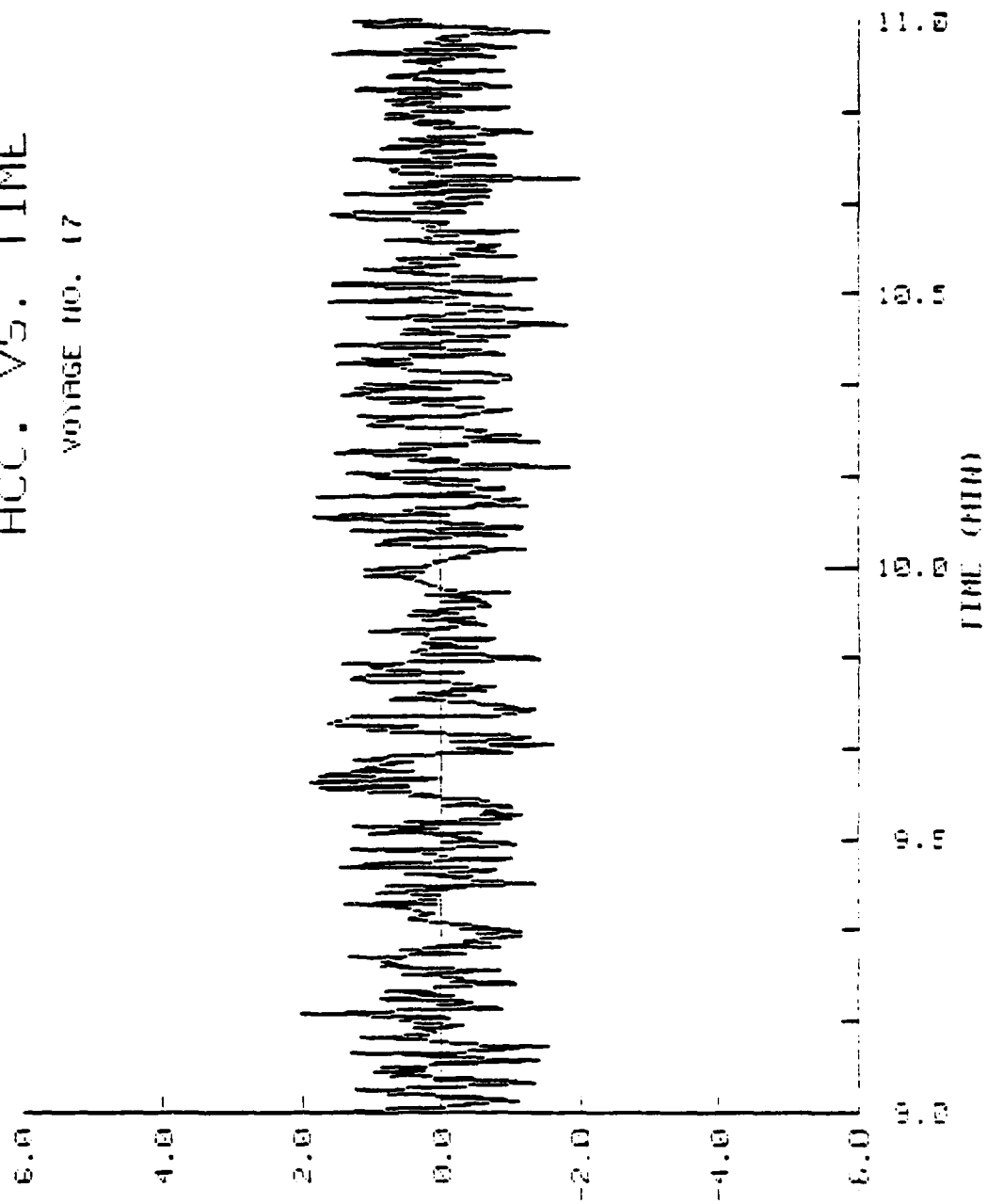


ROLL DEGS



ACC. VS. TIME

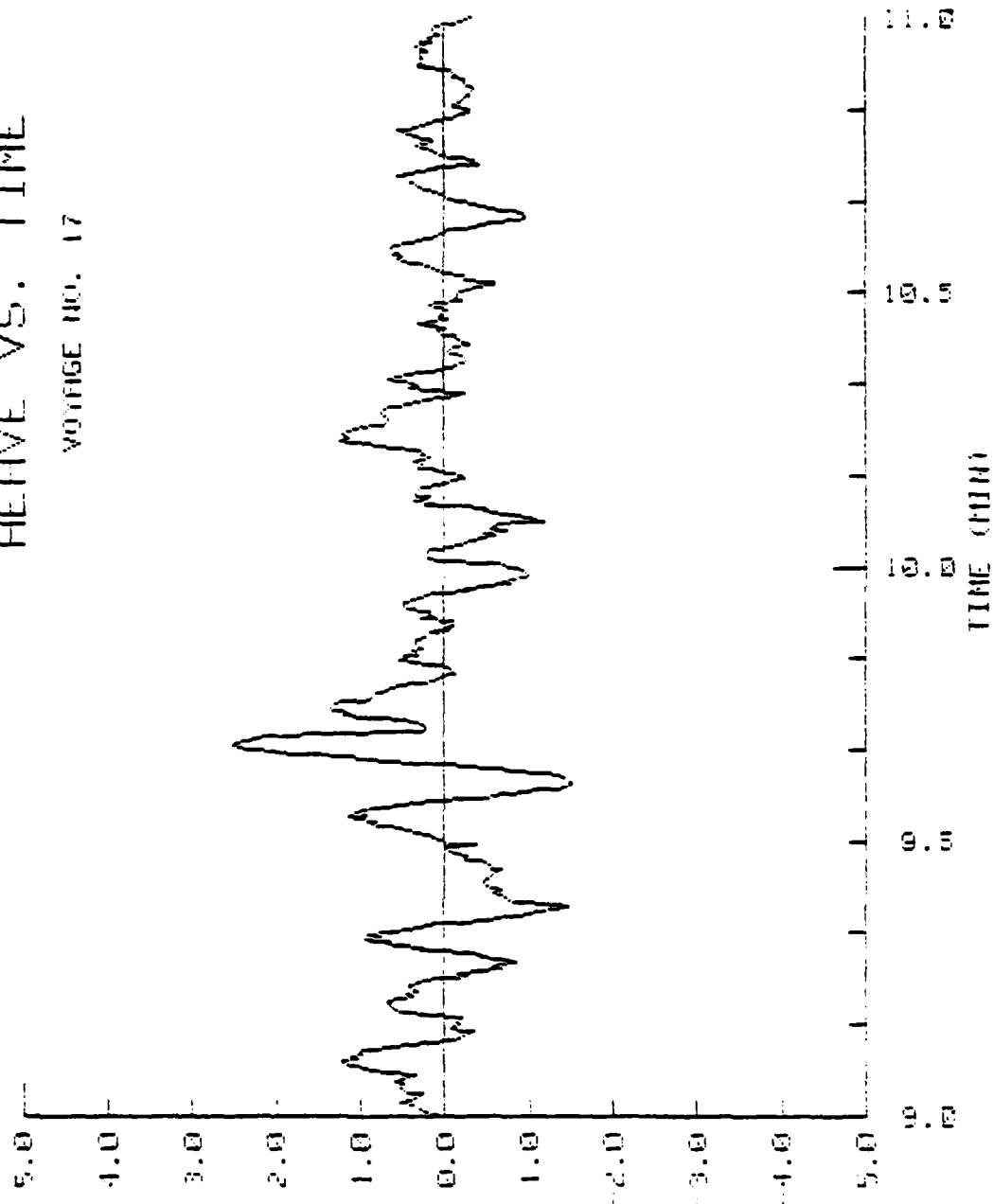
VORAGE NO. 17





# HEAVE VS. TIME

VOTAGE NO. 17

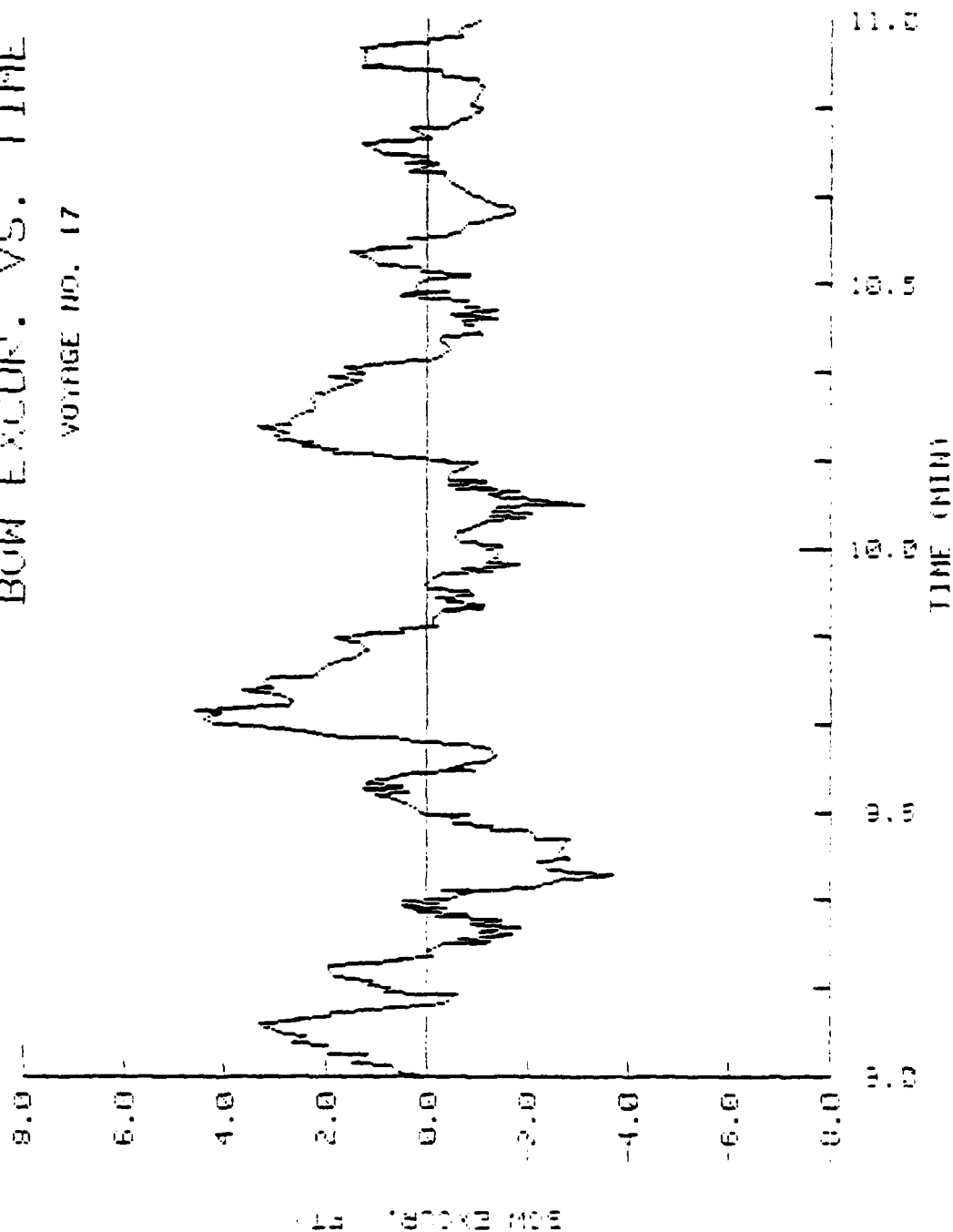


11-34107



# BCW EXCUR. VS. TIME

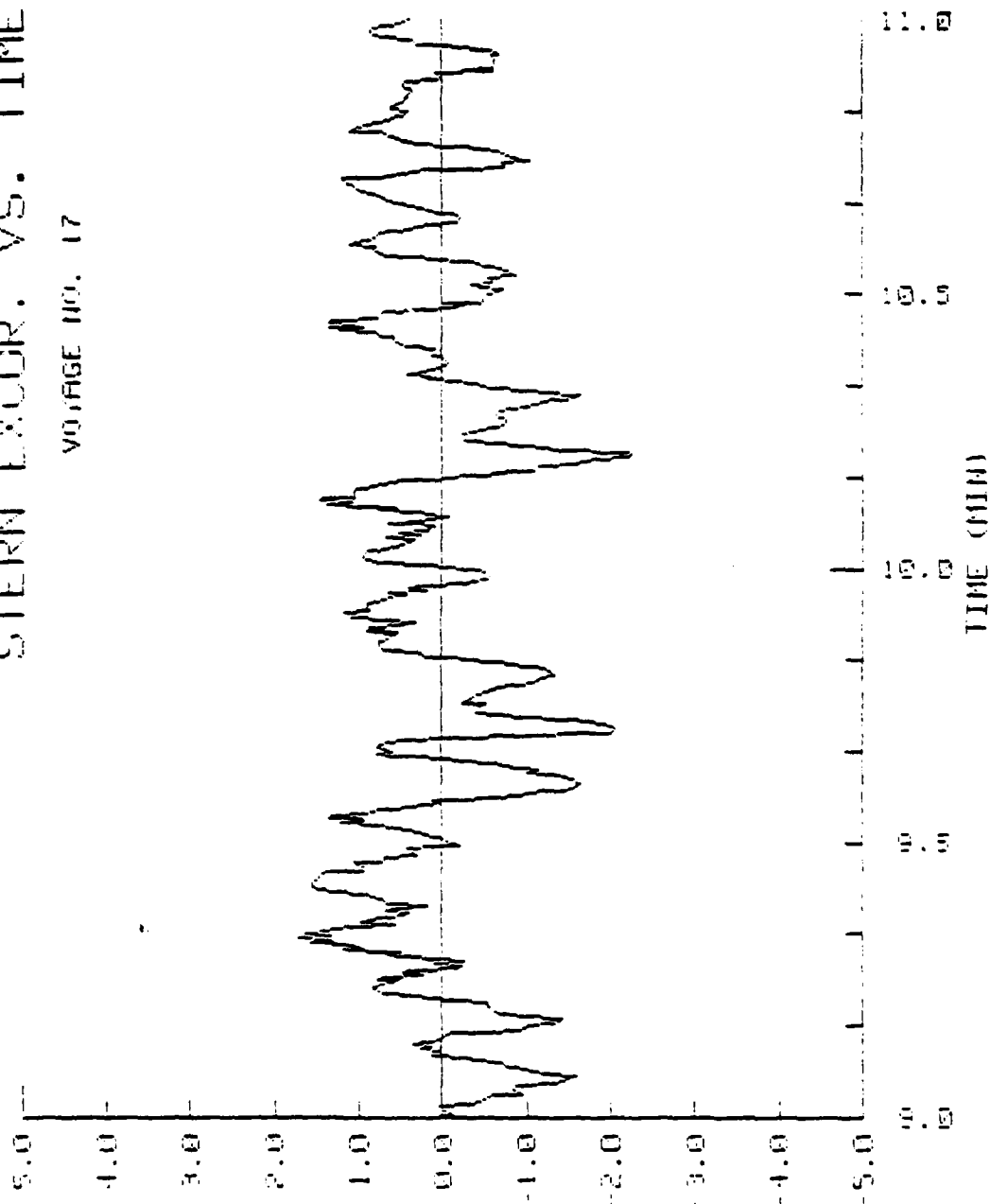
VOTAGE NO. 17





# STERN EXCUR. VS. TIME

VOLUME NO. 17

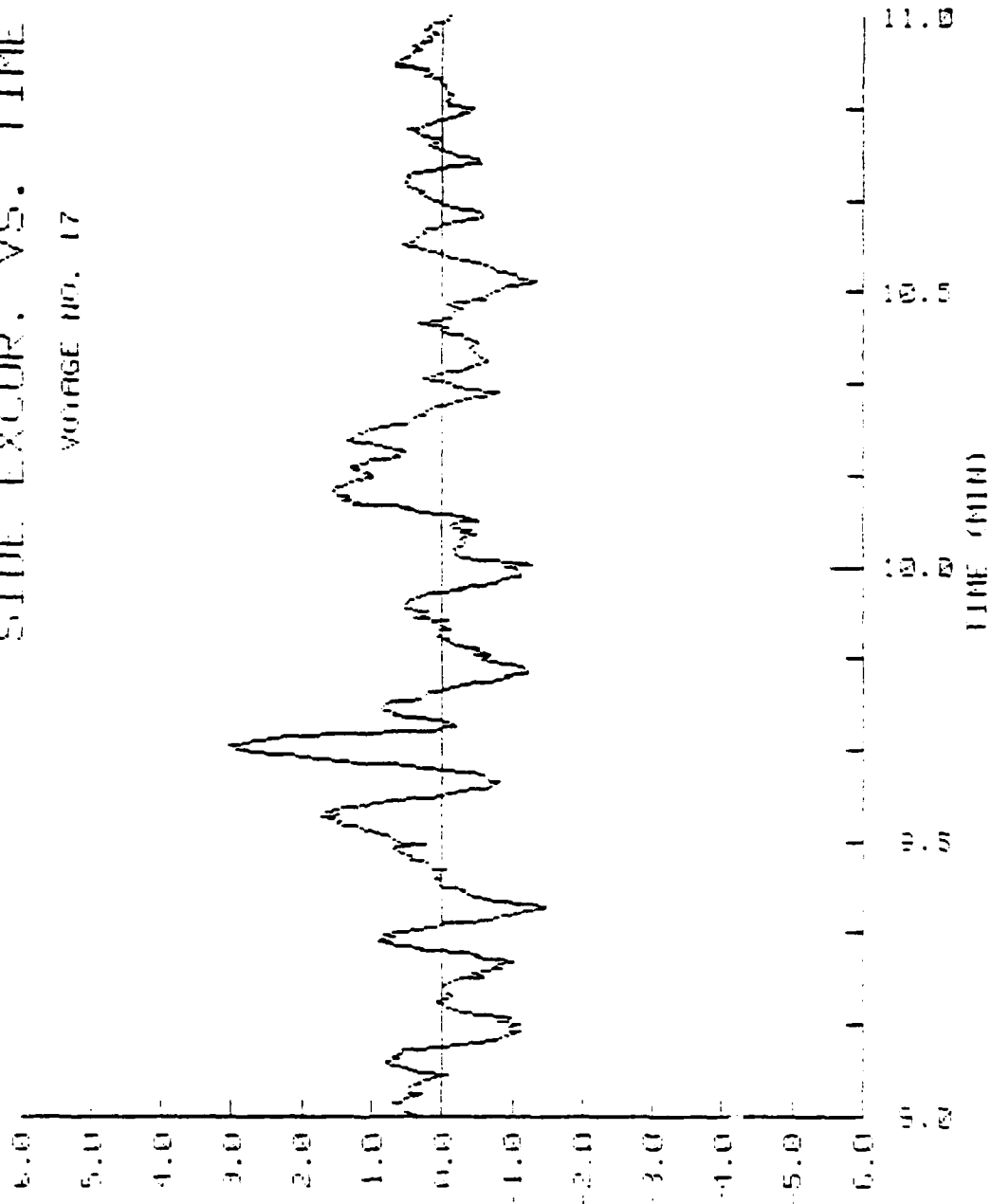


STERN EXCUR. 17



# SIDE EXCUR. VS. TIME

VOLUME NO. 17





# STATISTICAL SUMMARY

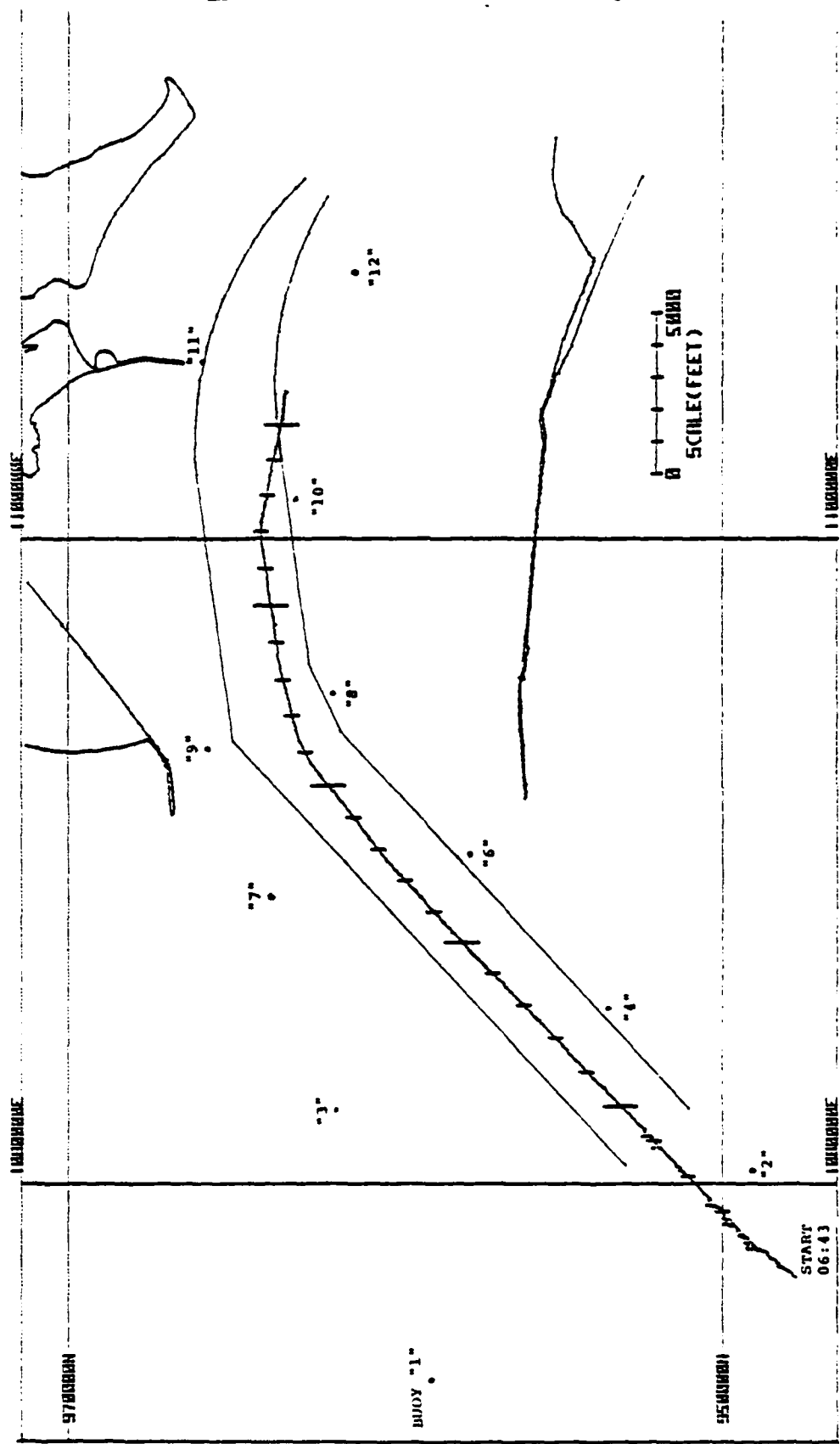
VOYAGE NO. 13

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-0.1	1.7	.4	.5
ROLL (DEG)	1.0	2.6	1.1	1.2
NO. (FT SEC/SEC)	.0	1.6	.6	.6
HEAVE (FT)	.0	3.8	1.2	1.4
ROLL EXCUR. (FT)	.0	5.1	1.3	1.5
STEEP EXCUR. (FT)	-0.0	12.4	2.6	3.3
SIDE EXCUR (FT)	.0	4.3	1.5	1.7



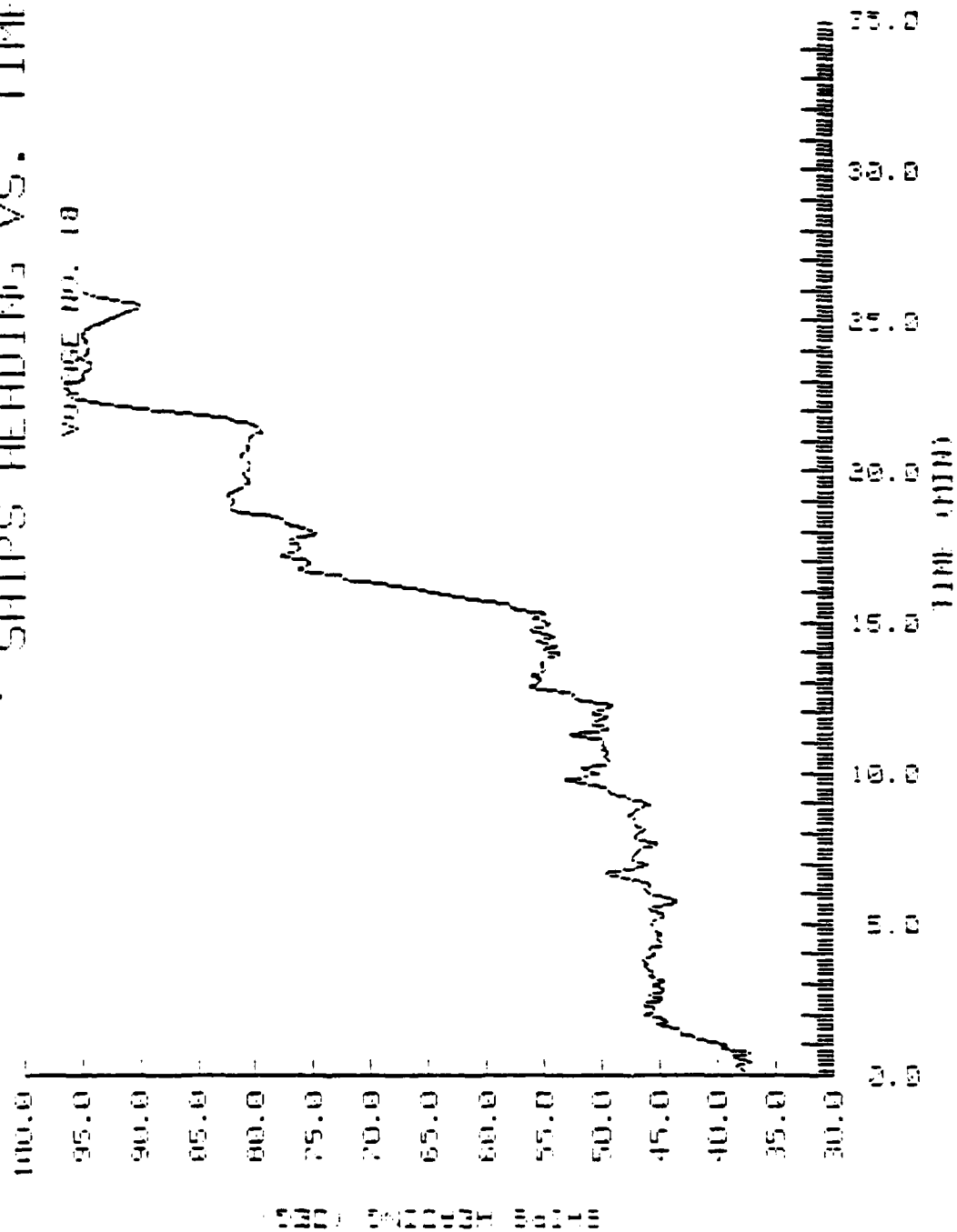
VOYAGE NO. 18 SHIP TRACK

SCALE 1: 30000





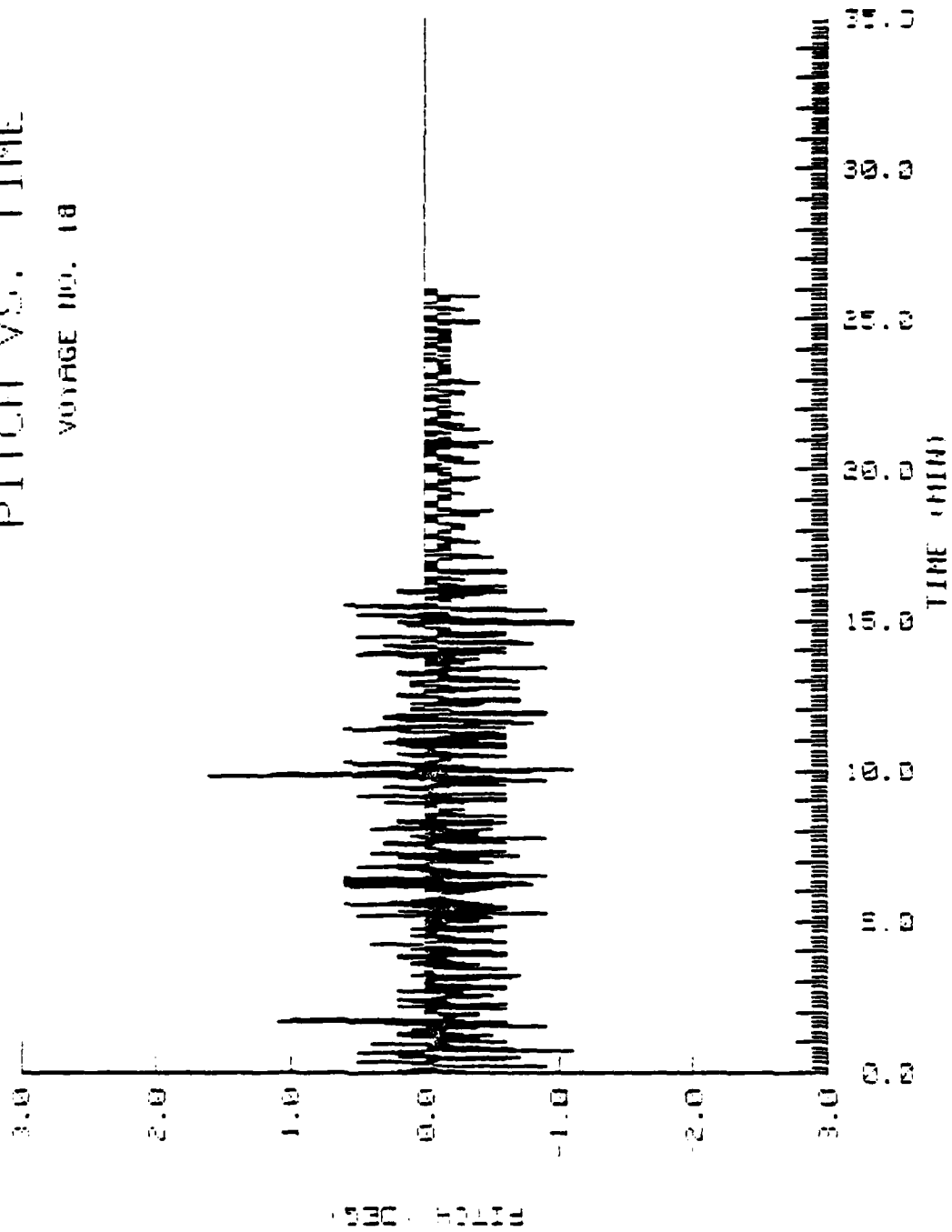
# SHIPS HEADING VS. TIME





# PITCH VS. TIME

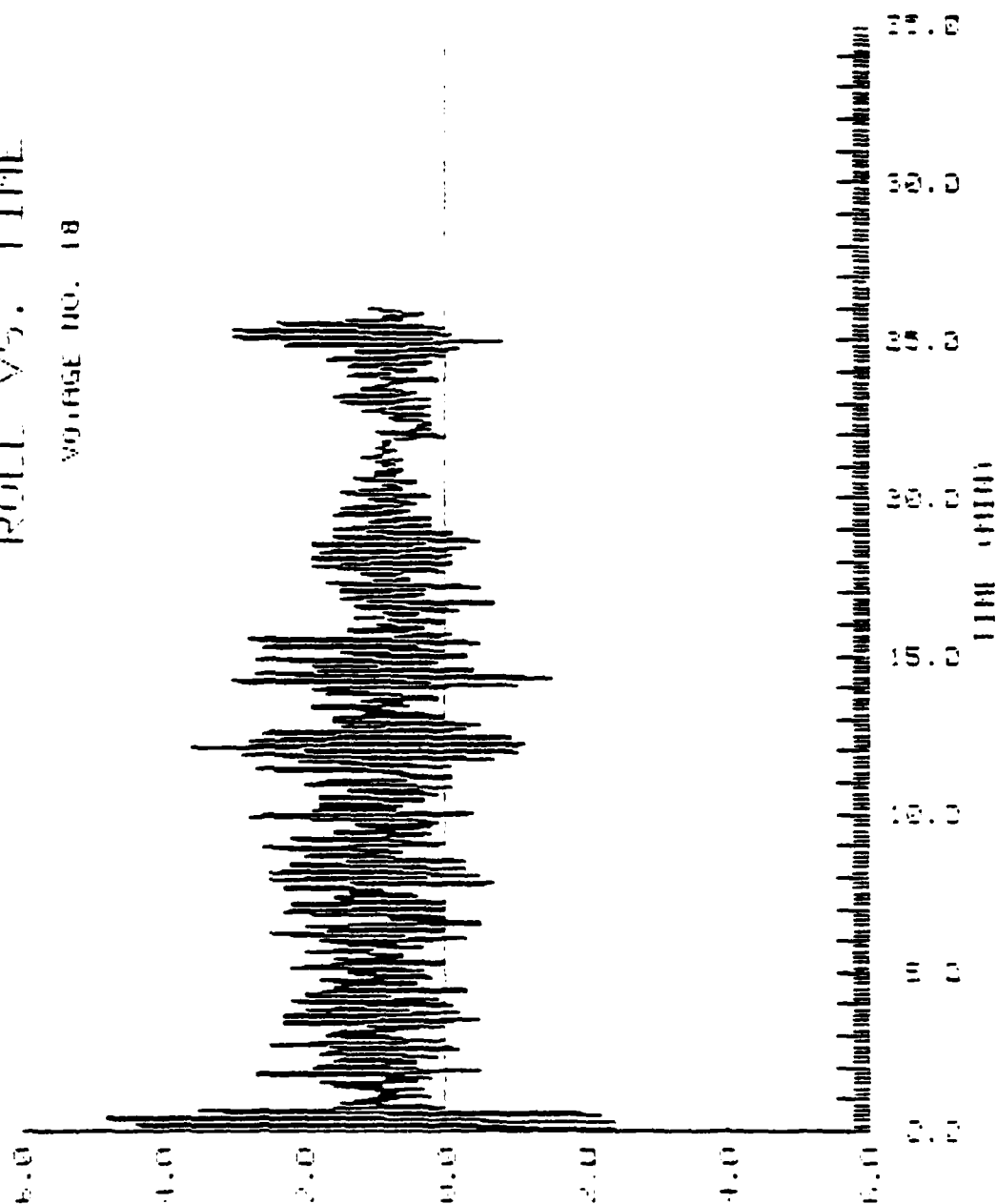
VOLUME NO. 18





# ROLL V% TIME

VOLUME NO. 18

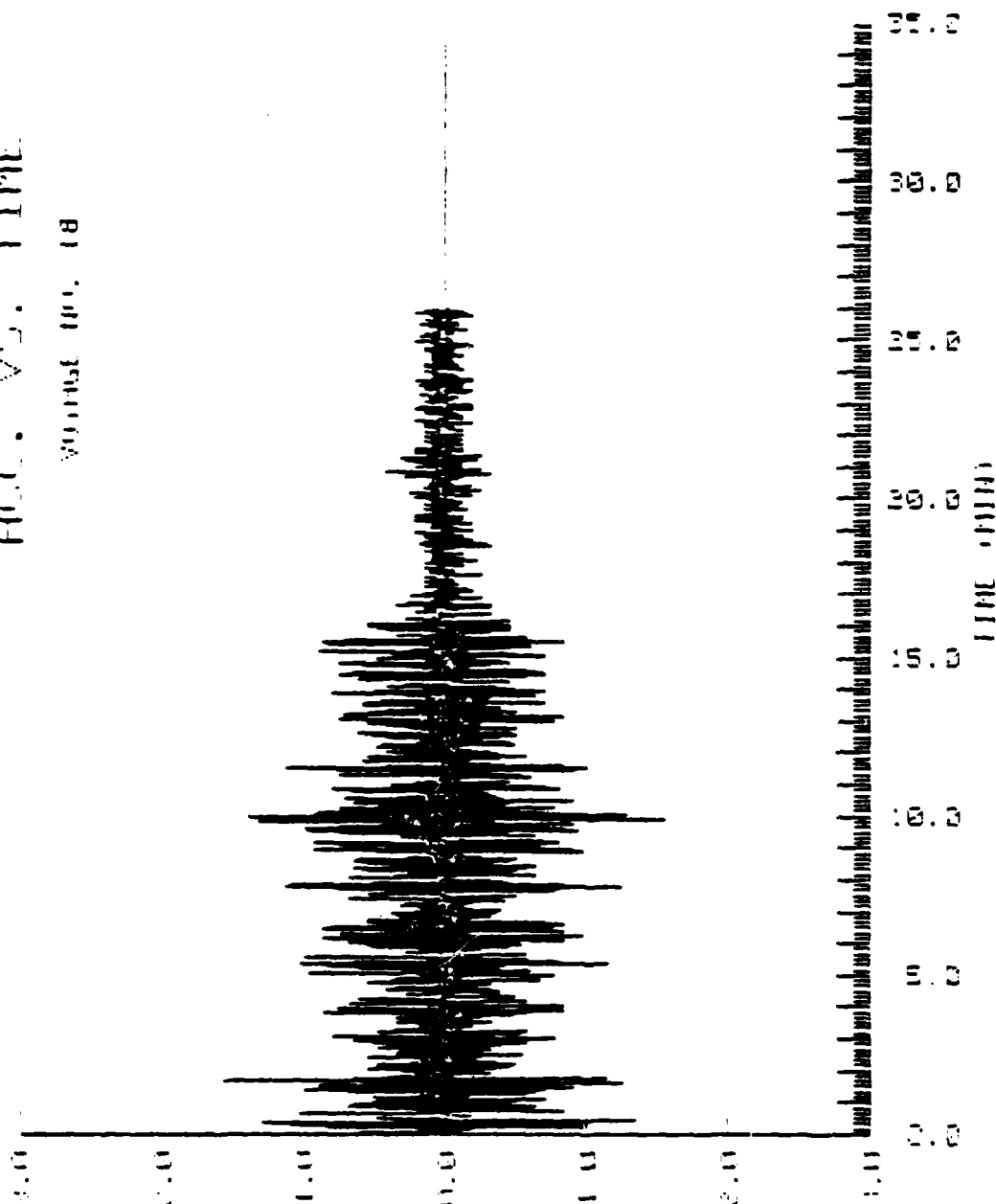


222 7706



REC. VS. TIME

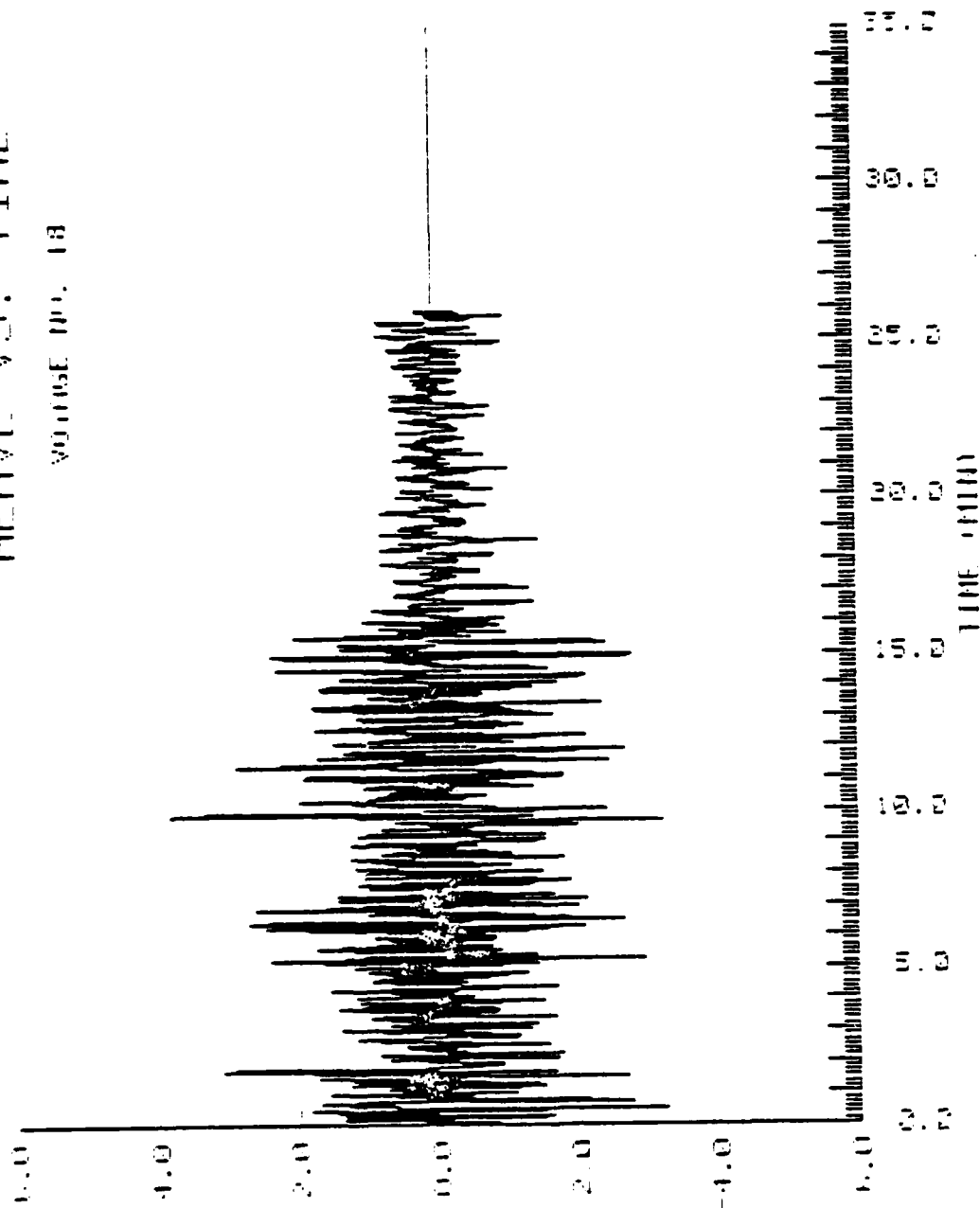
WIND NO. 18





# HEAVY VS. TIME

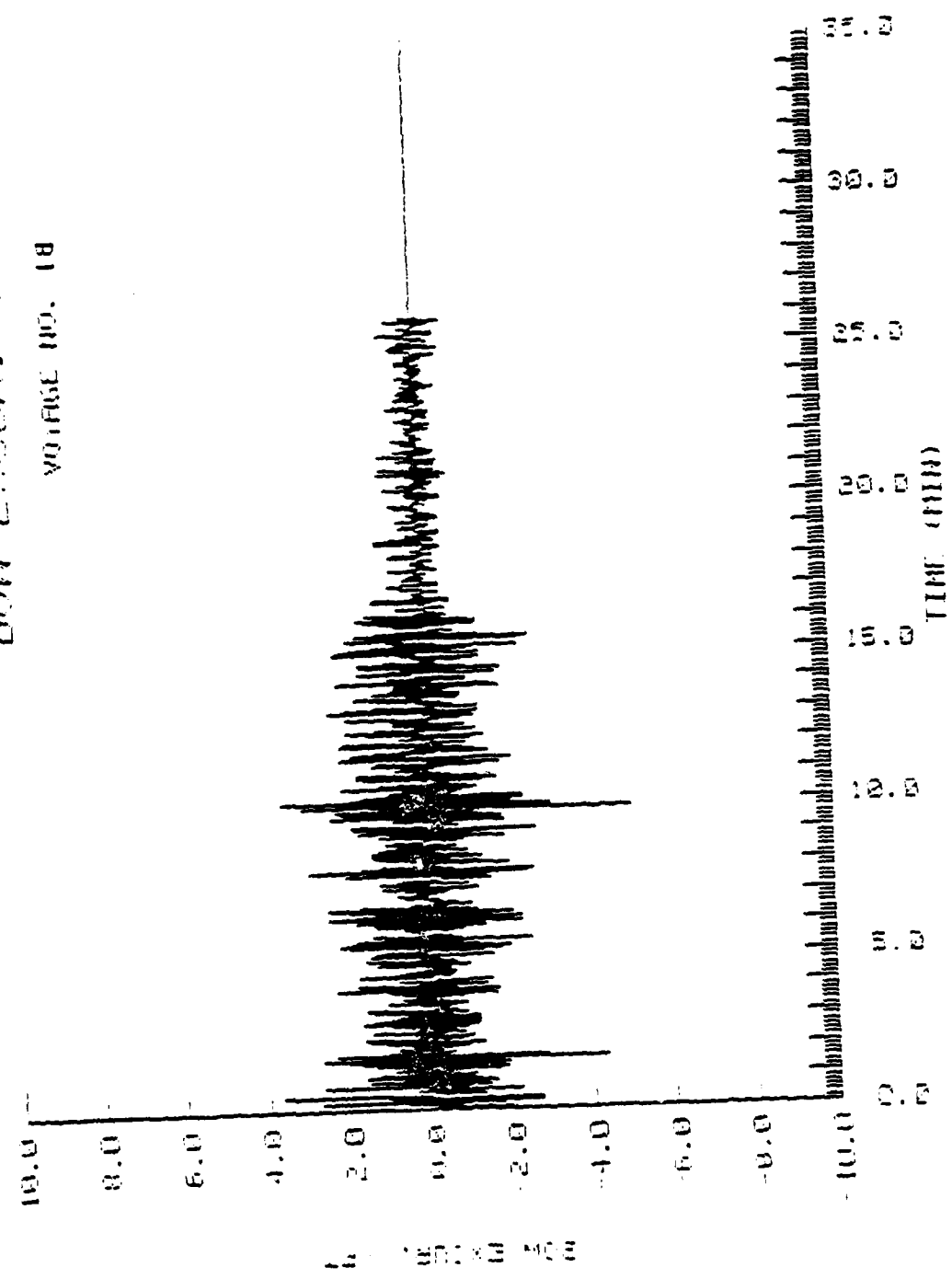
VOLUME 100, 18





# BOM EXCUR. VS. TIME

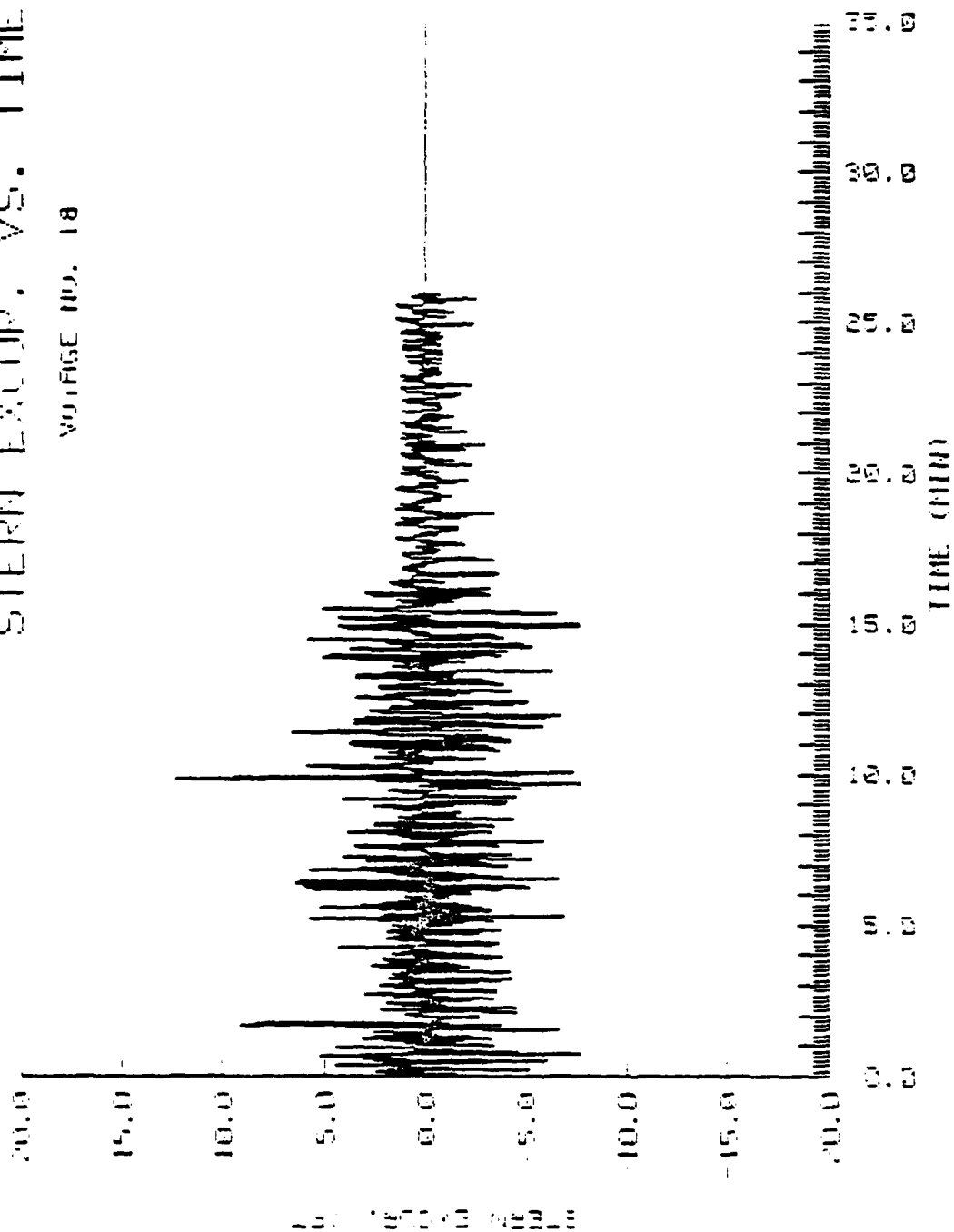
VOLAGE NO. 18





# STERN EXCIP. VS. TIME

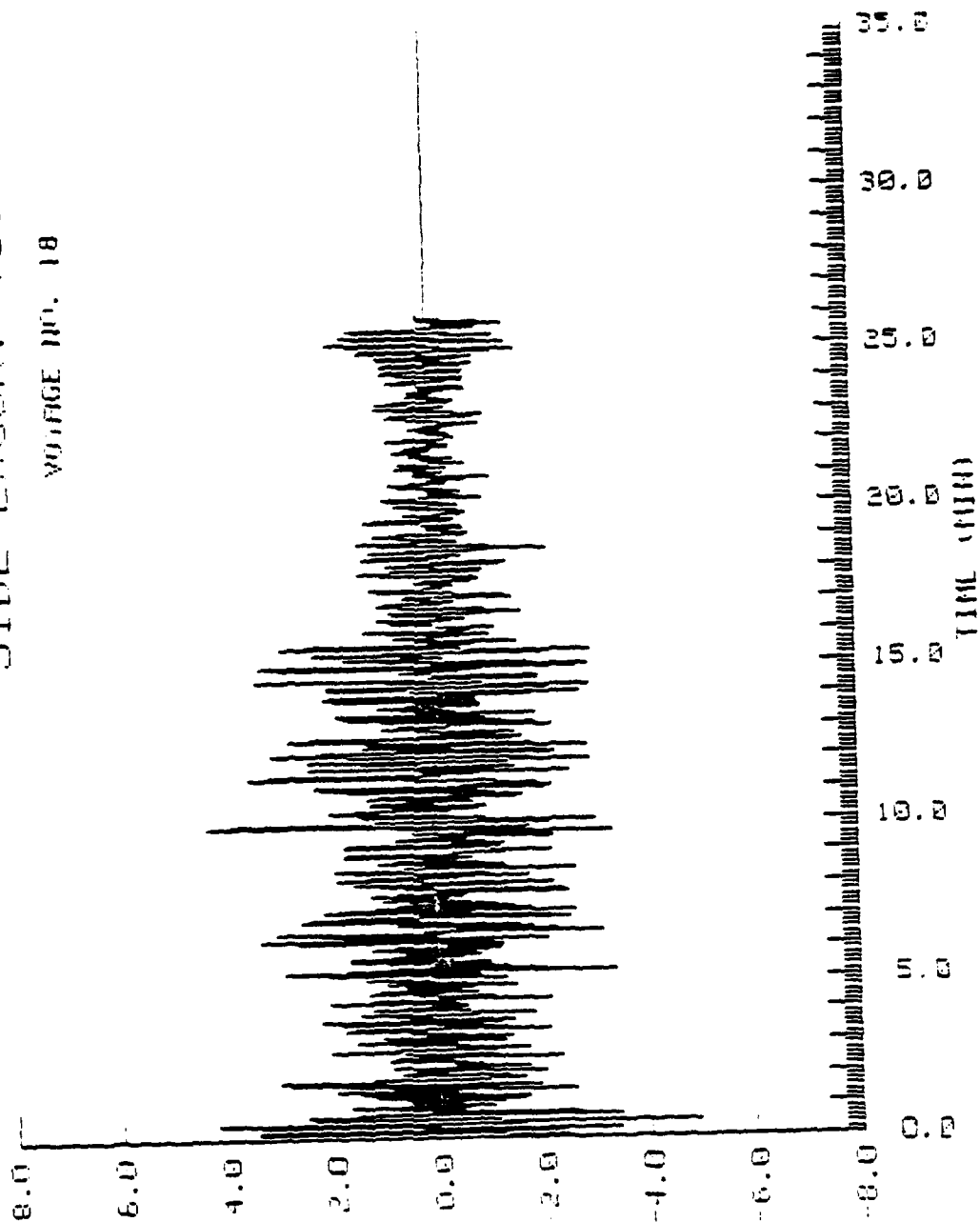
VOLUME NO. 18





# SIDE EXCUR. VS. TIME

VOICE NO. 18

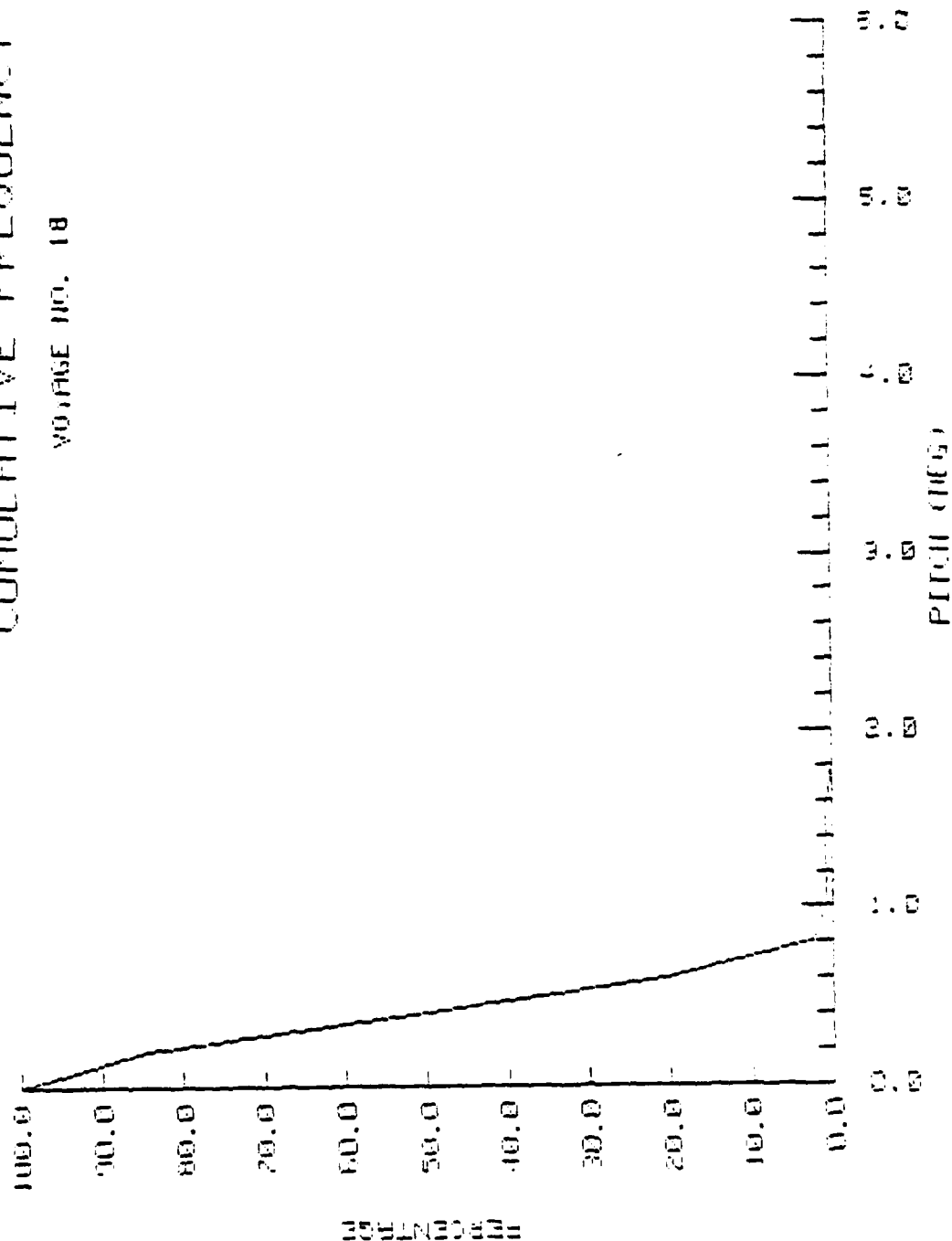


11. 12000 0016



# CUMULATIVE FREQUENCY

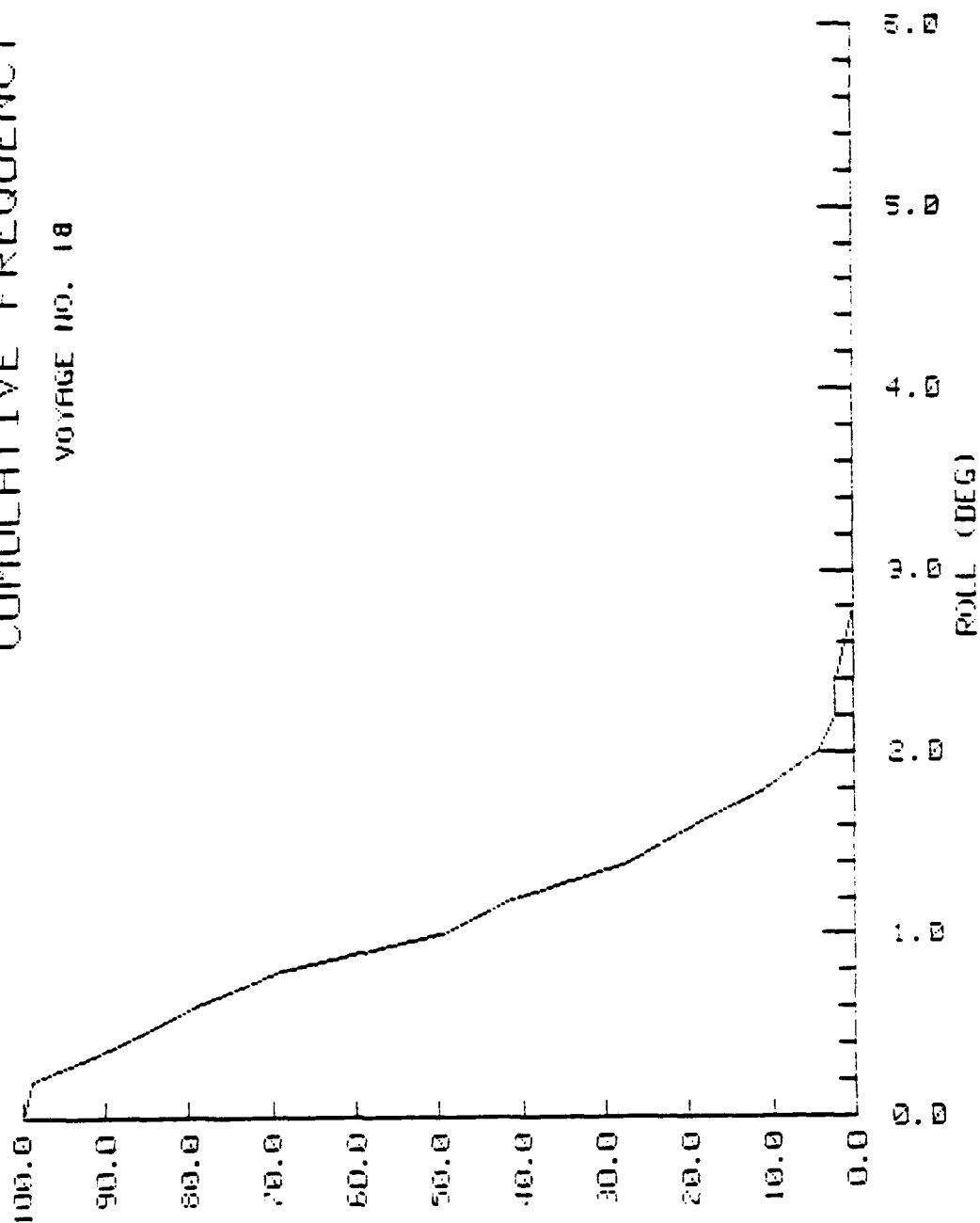
VOLUME NO. 18





# CUMULATIVE FREQUENCY

VOYAGE NO. 18

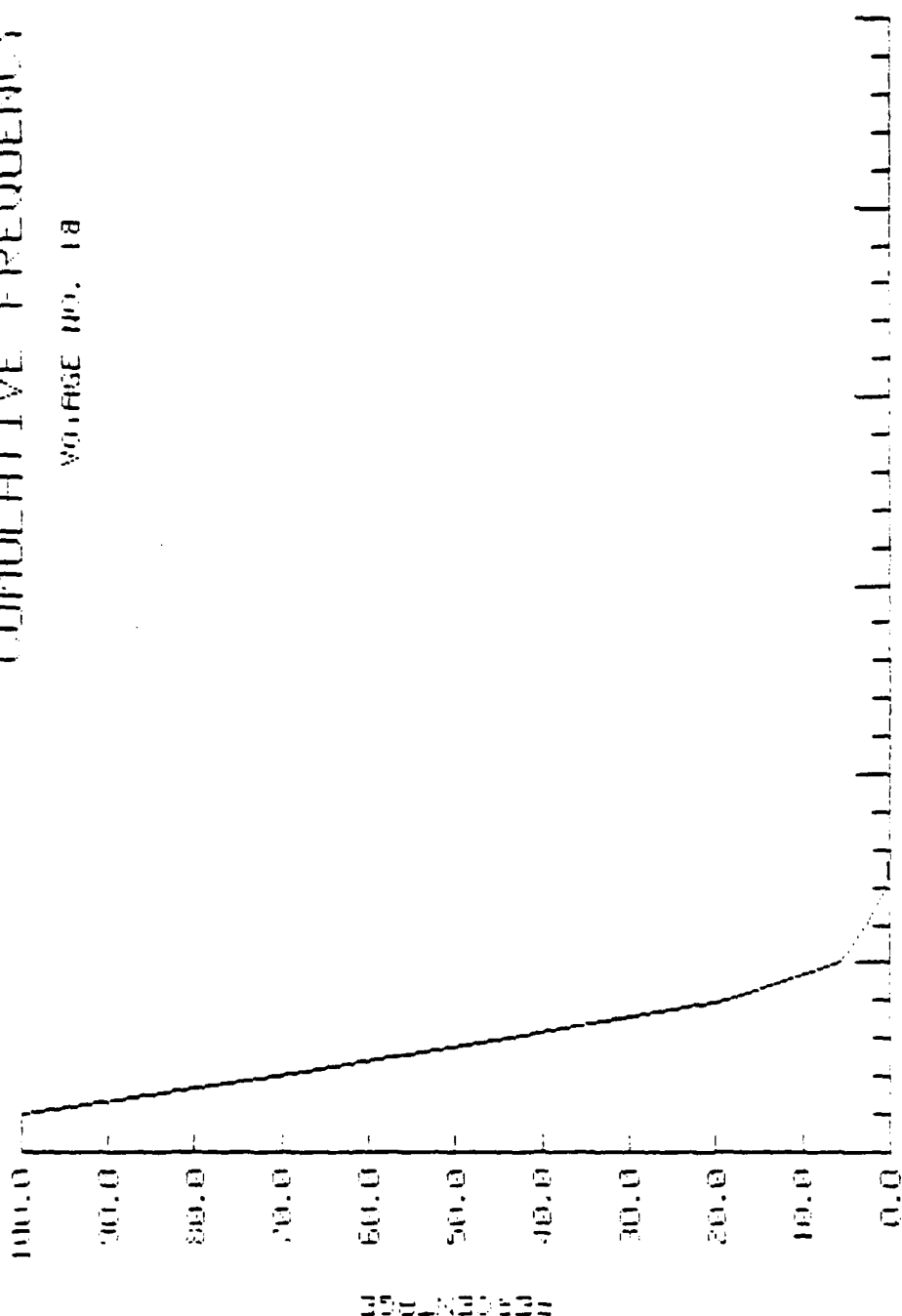


PERCENT



# CUMULATIVE FREQUENCY

VOLAGE NO. 18

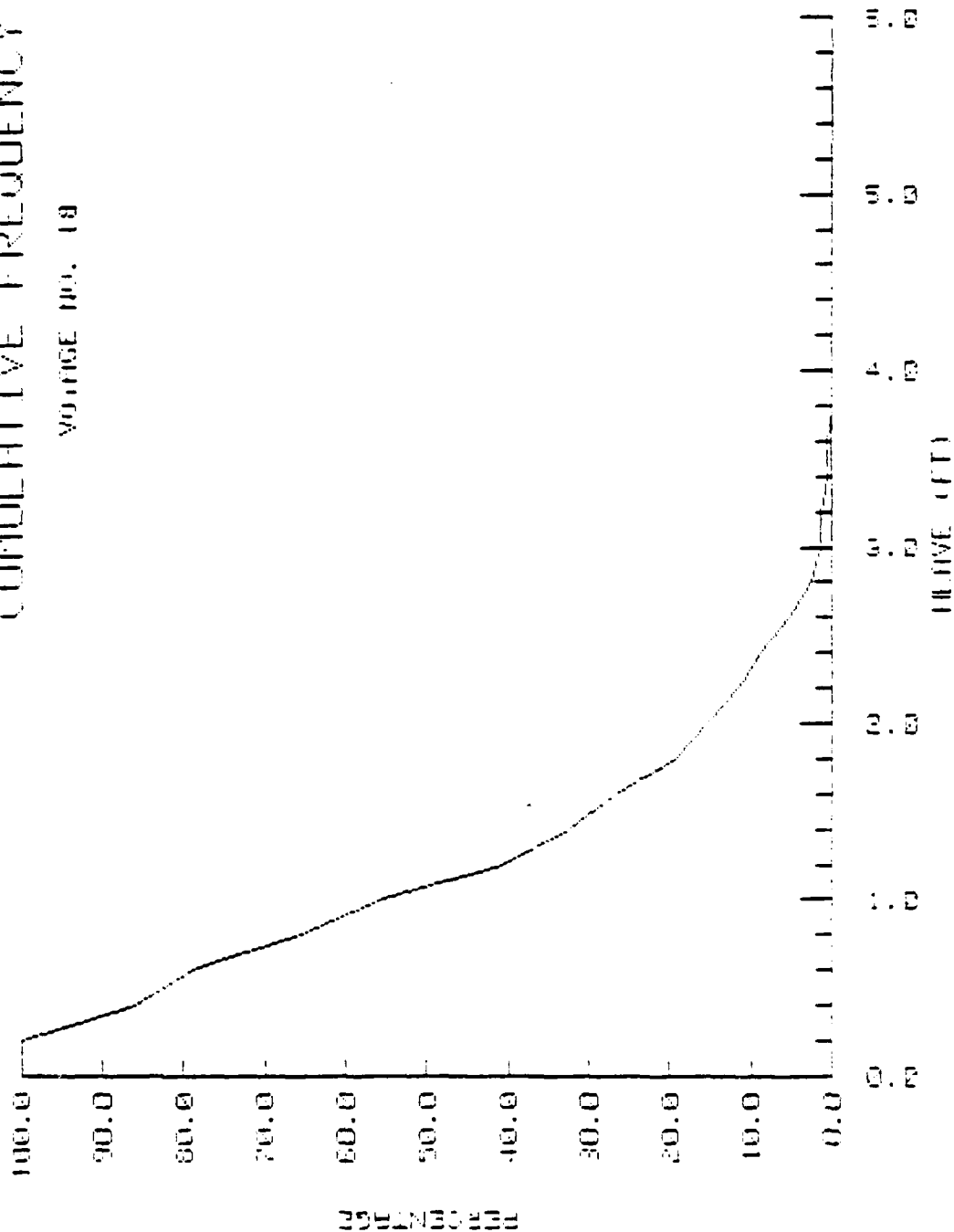


NO. OF SECTIONS



# CUMULATIVE FREQUENCY

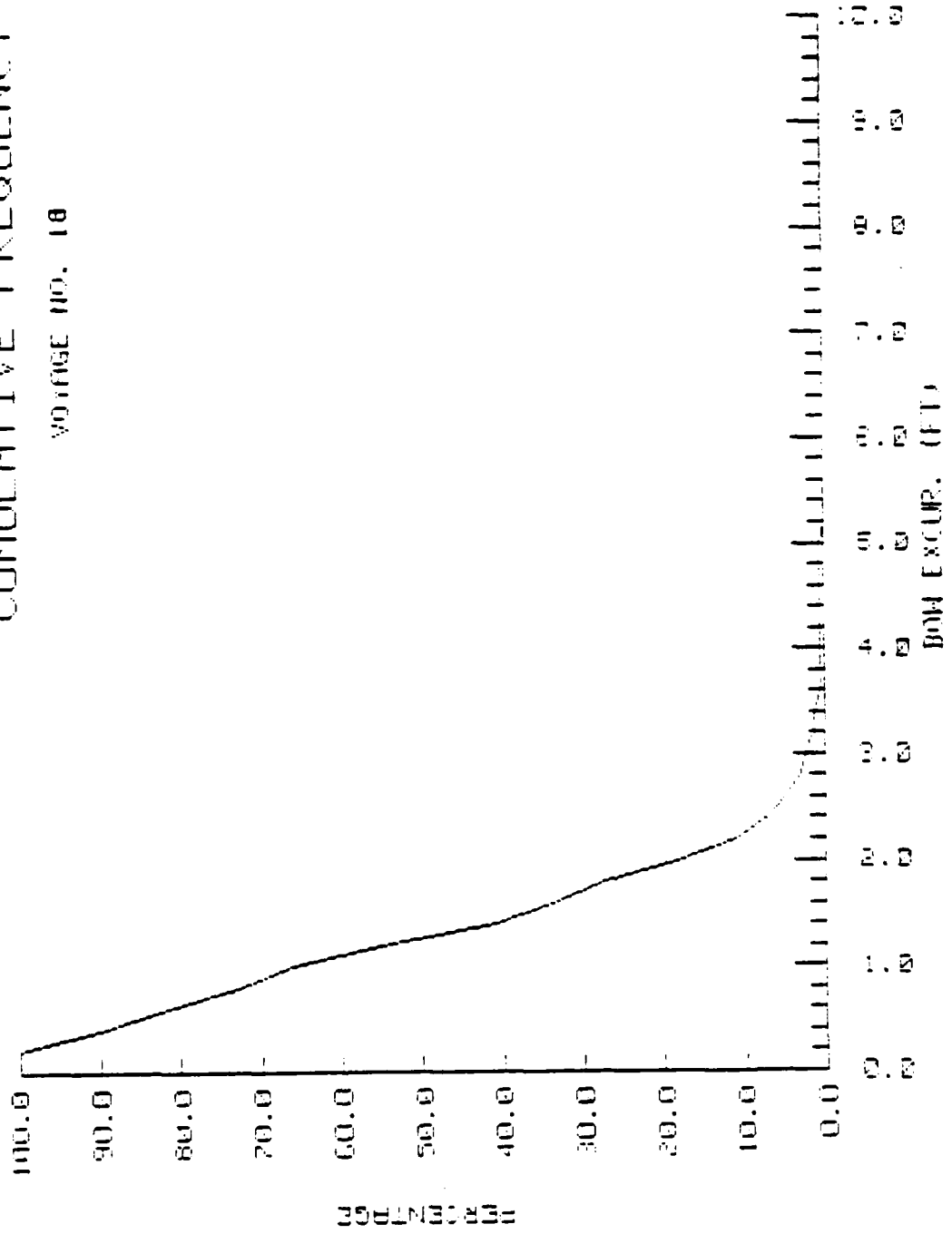
VOLUME NO. 18





# CUMULATIVE FREQUENCY

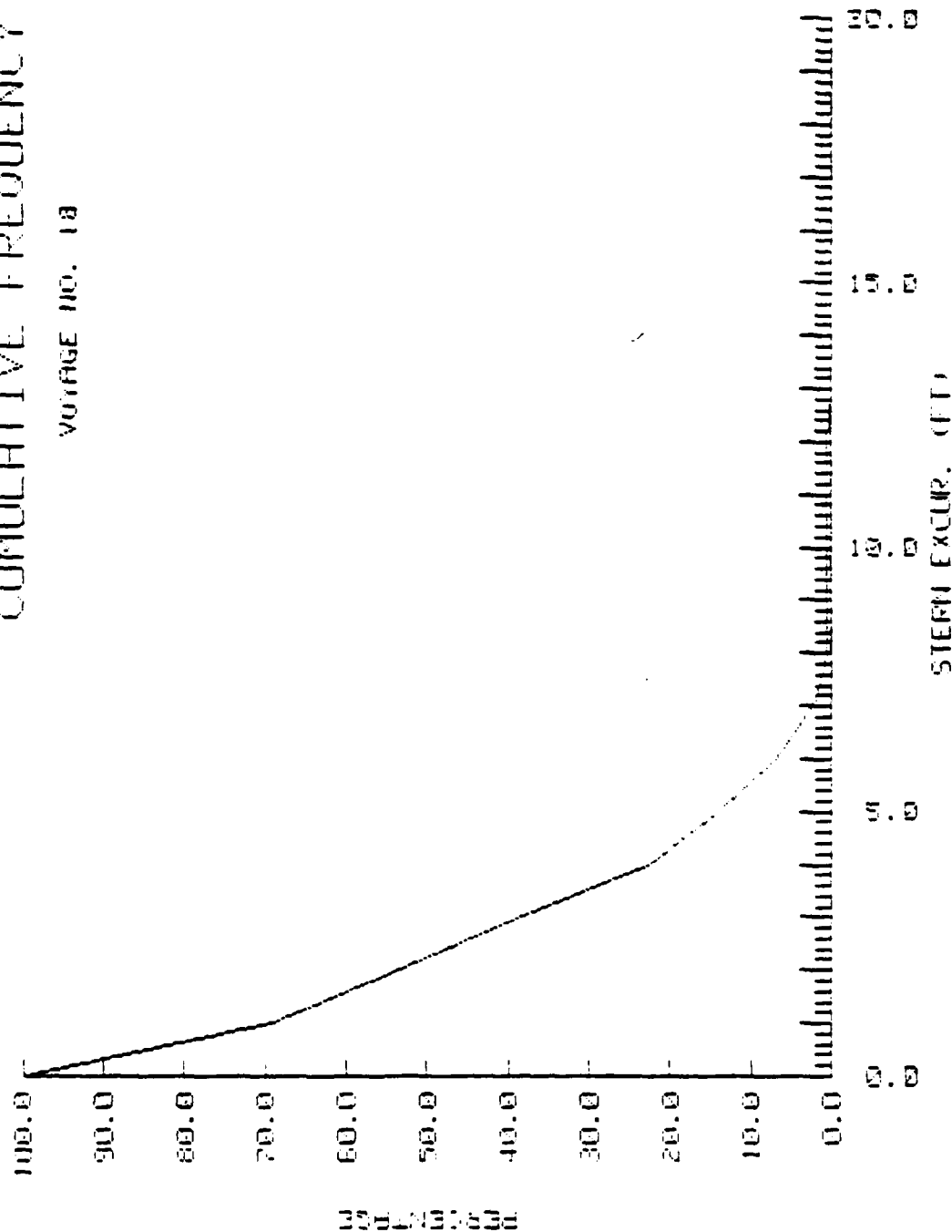
VOLUME NO. 18





# CUMULATIVE FREQUENCY

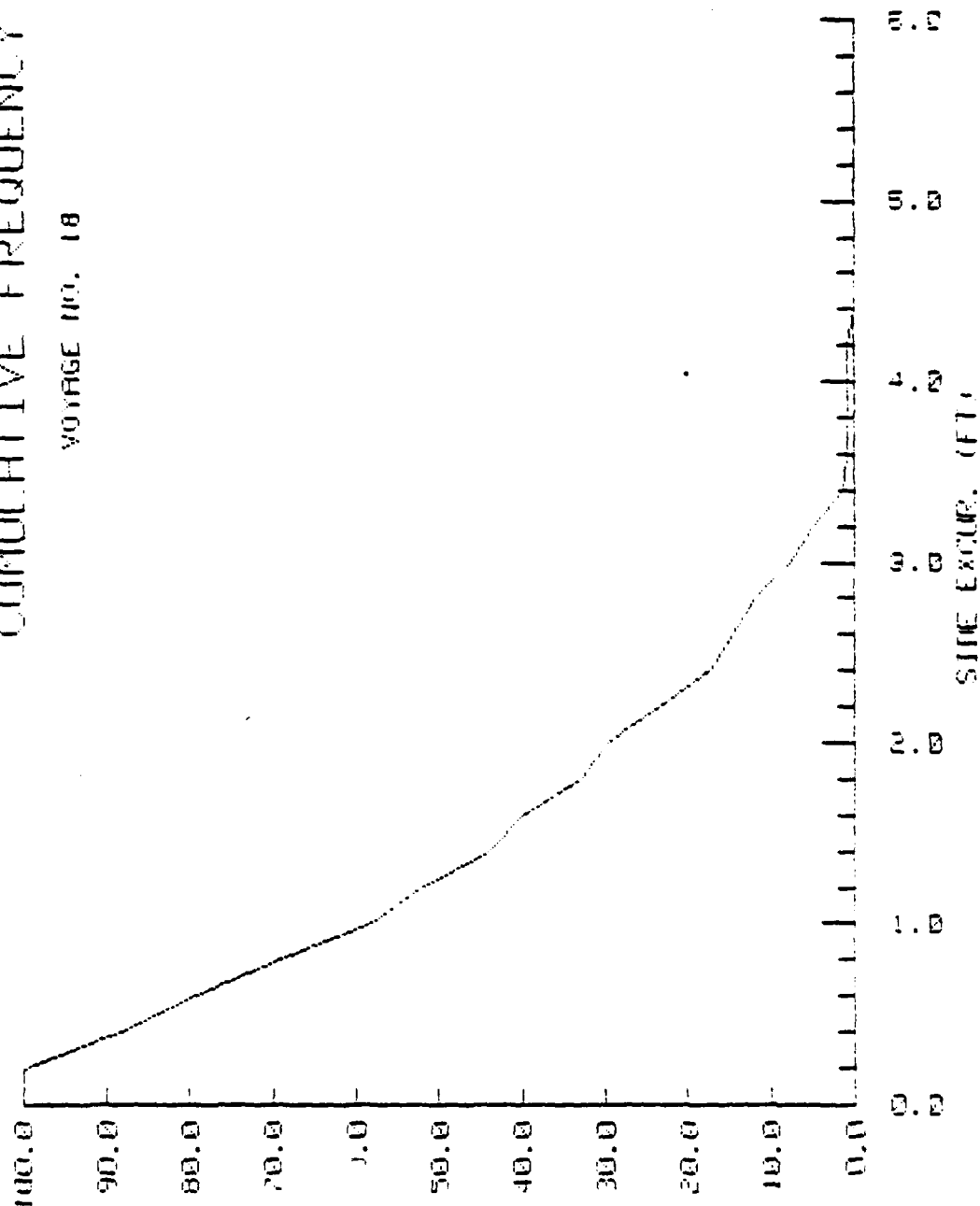
VOTAGE NO. 18





# CUMULATIVE FREQUENCY

VOYAGE NO. 18

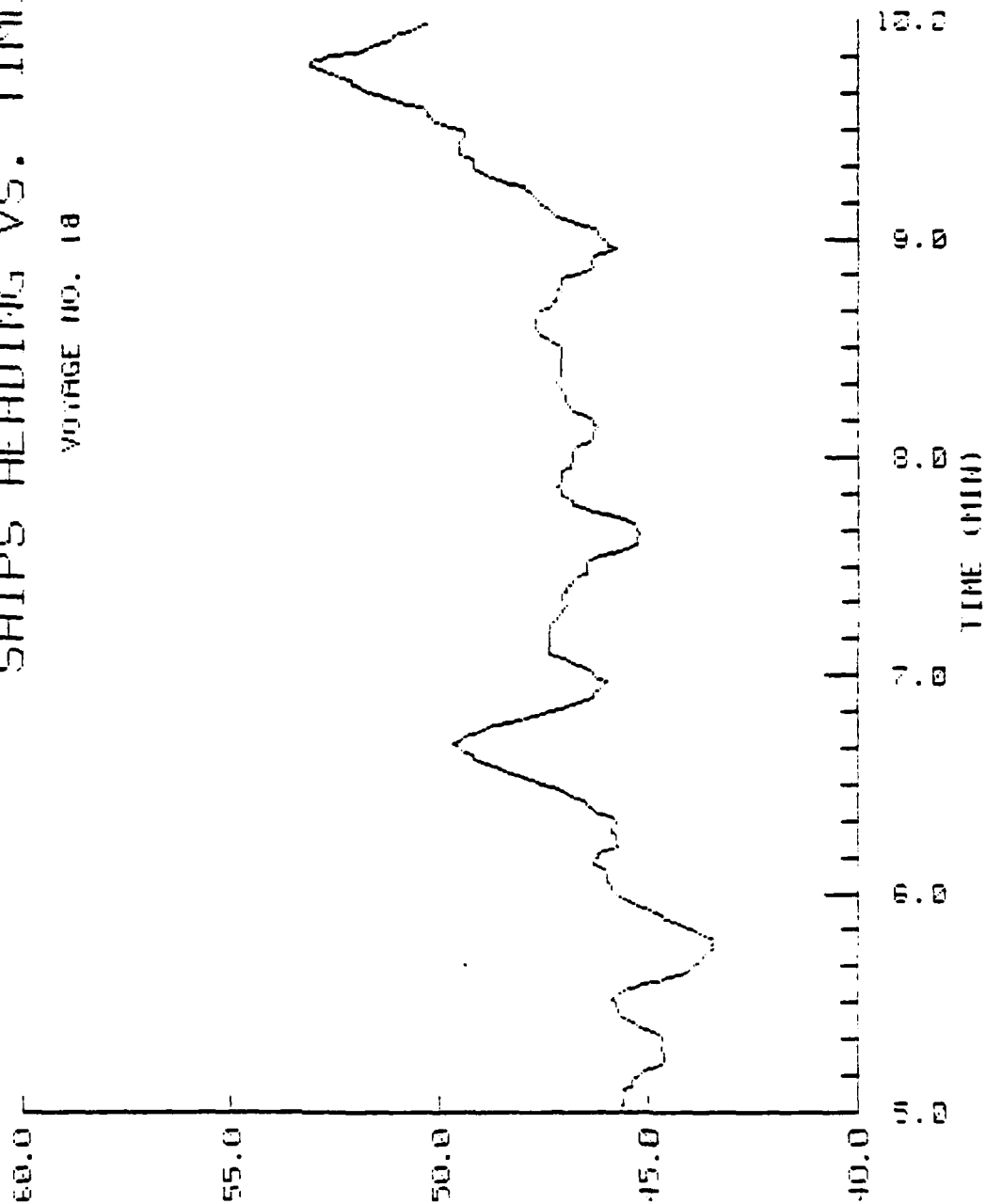


PERCENT



# SHIPS HEADING VS. TIME

VOTAGE NO. 18

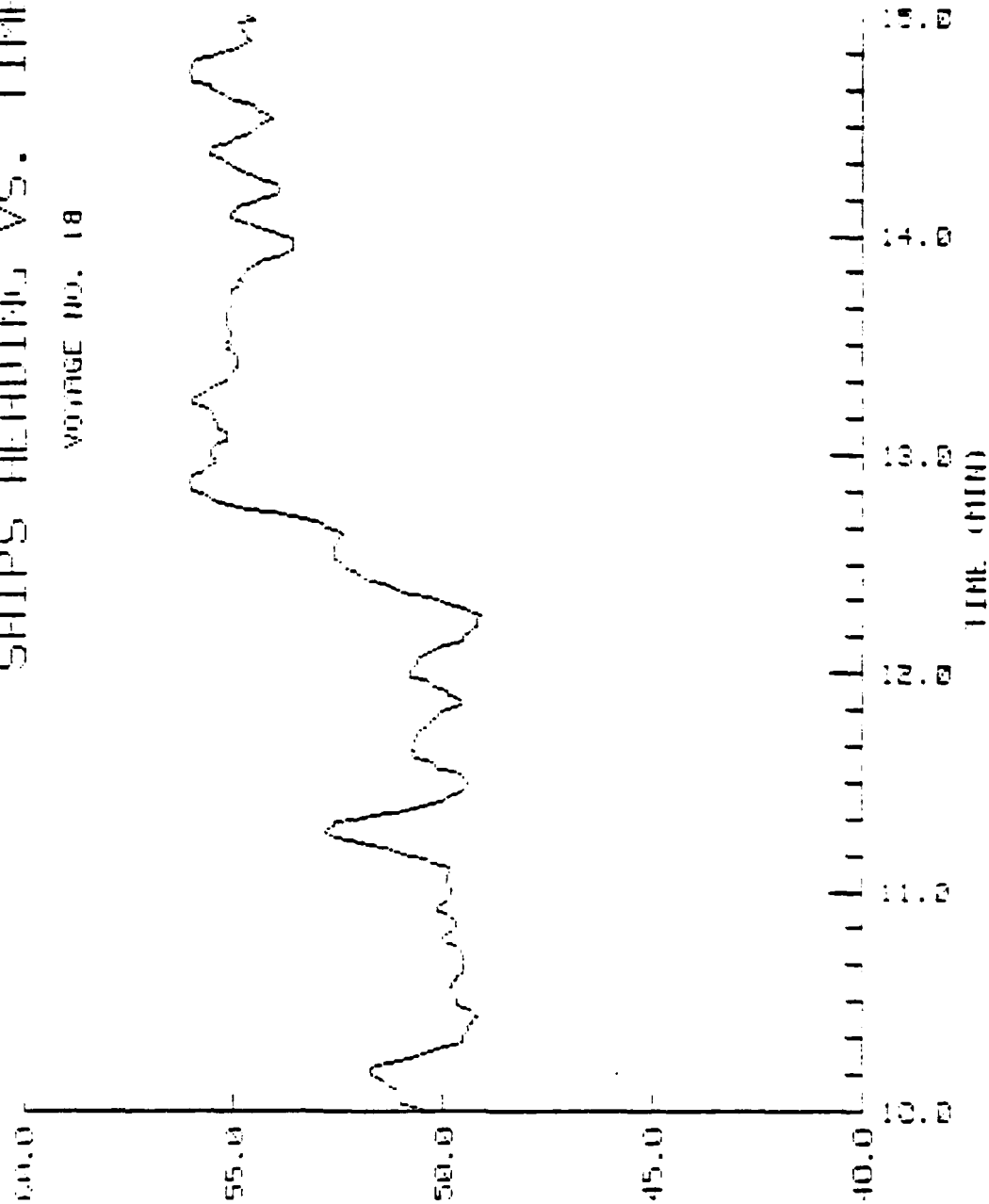


SHIPS HEADING (DEG)



# SHIPS HEADING VS. TIME

VOLUME NO. 18

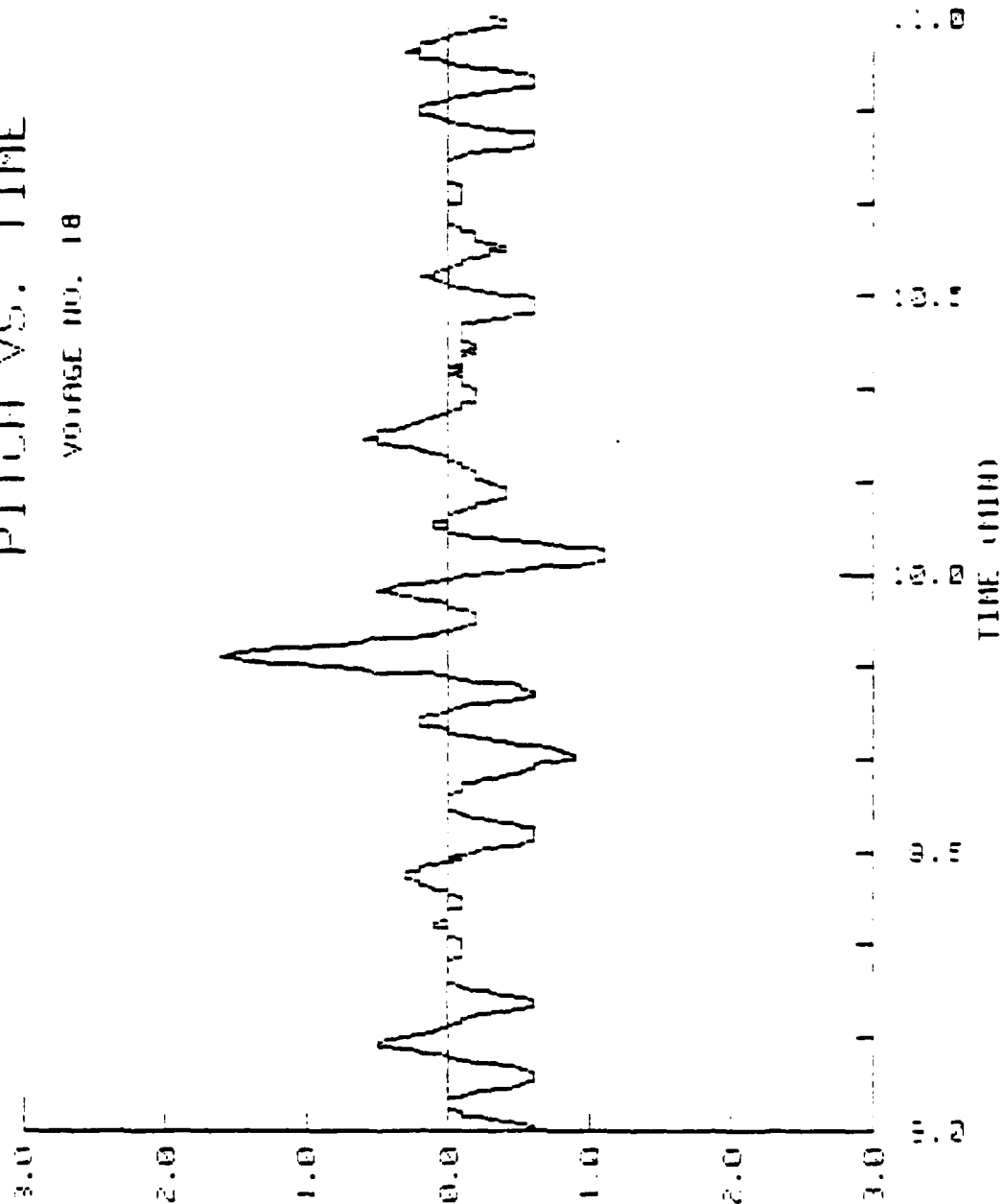


SHIPS HEADING VS. TIME



# PITCH VS. TIME

VOLUME NO. 18

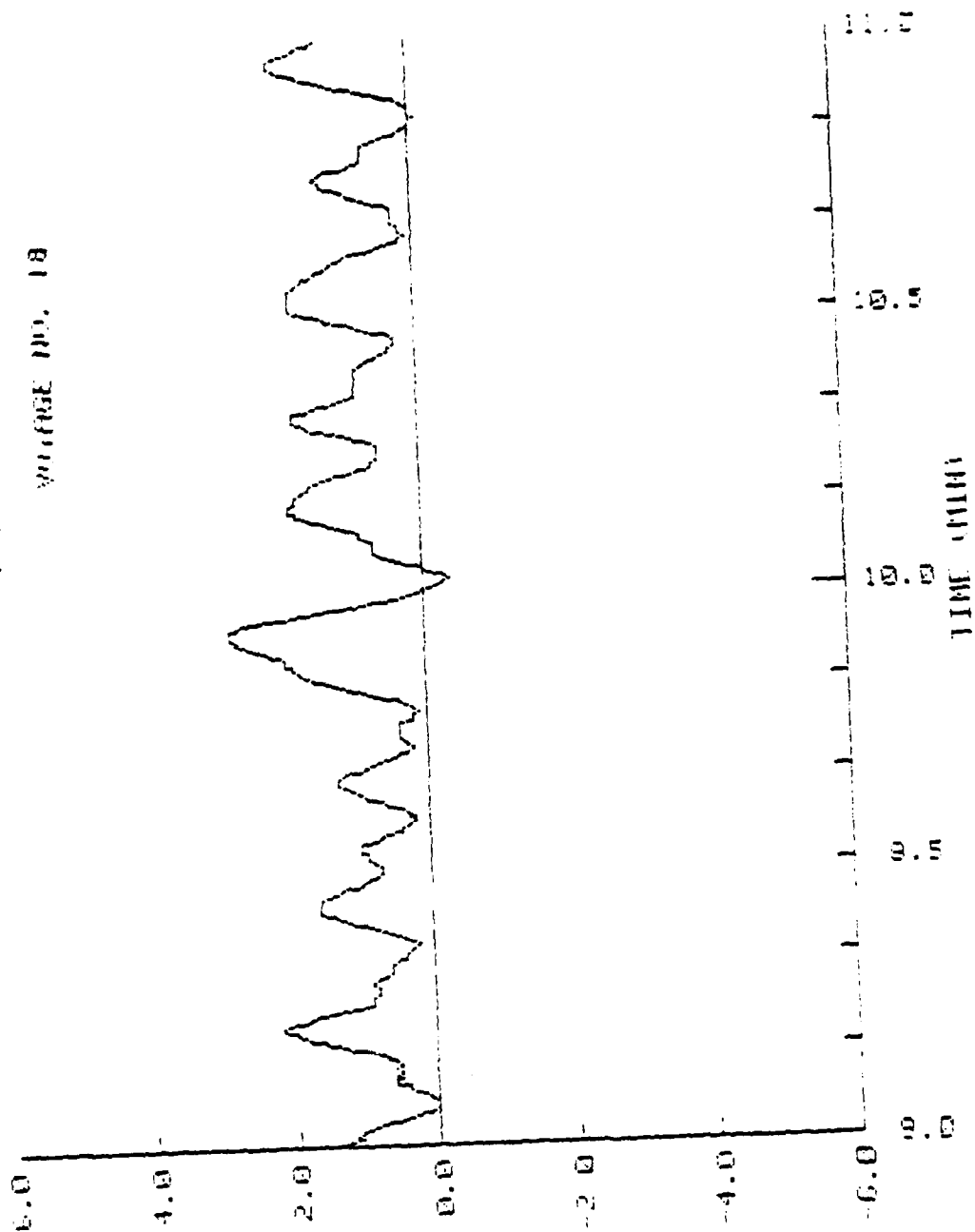


100 10000



# POLL VS. TIME

WAVE NO. 18

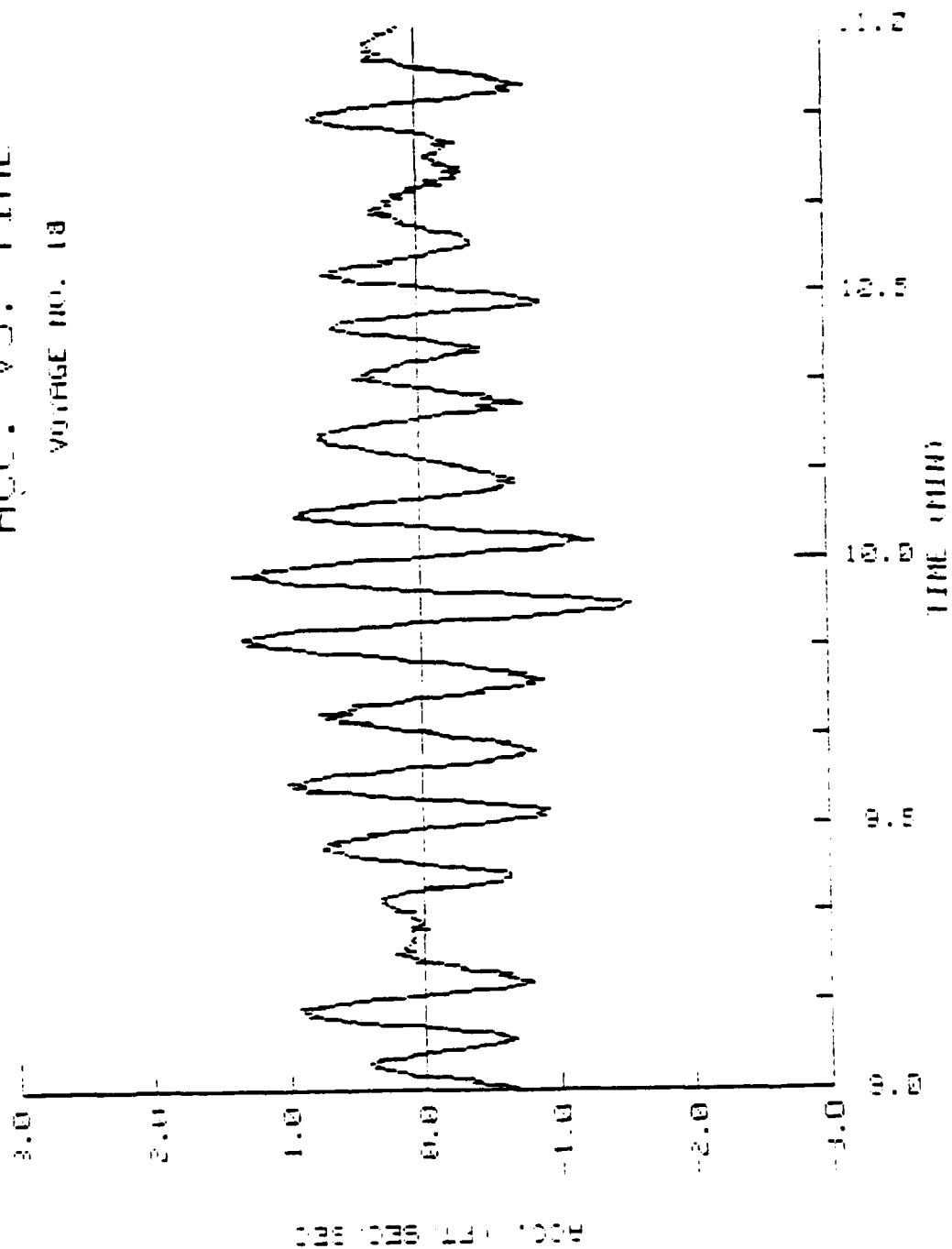


WAVE NO. 18



ACC. VS. TIME

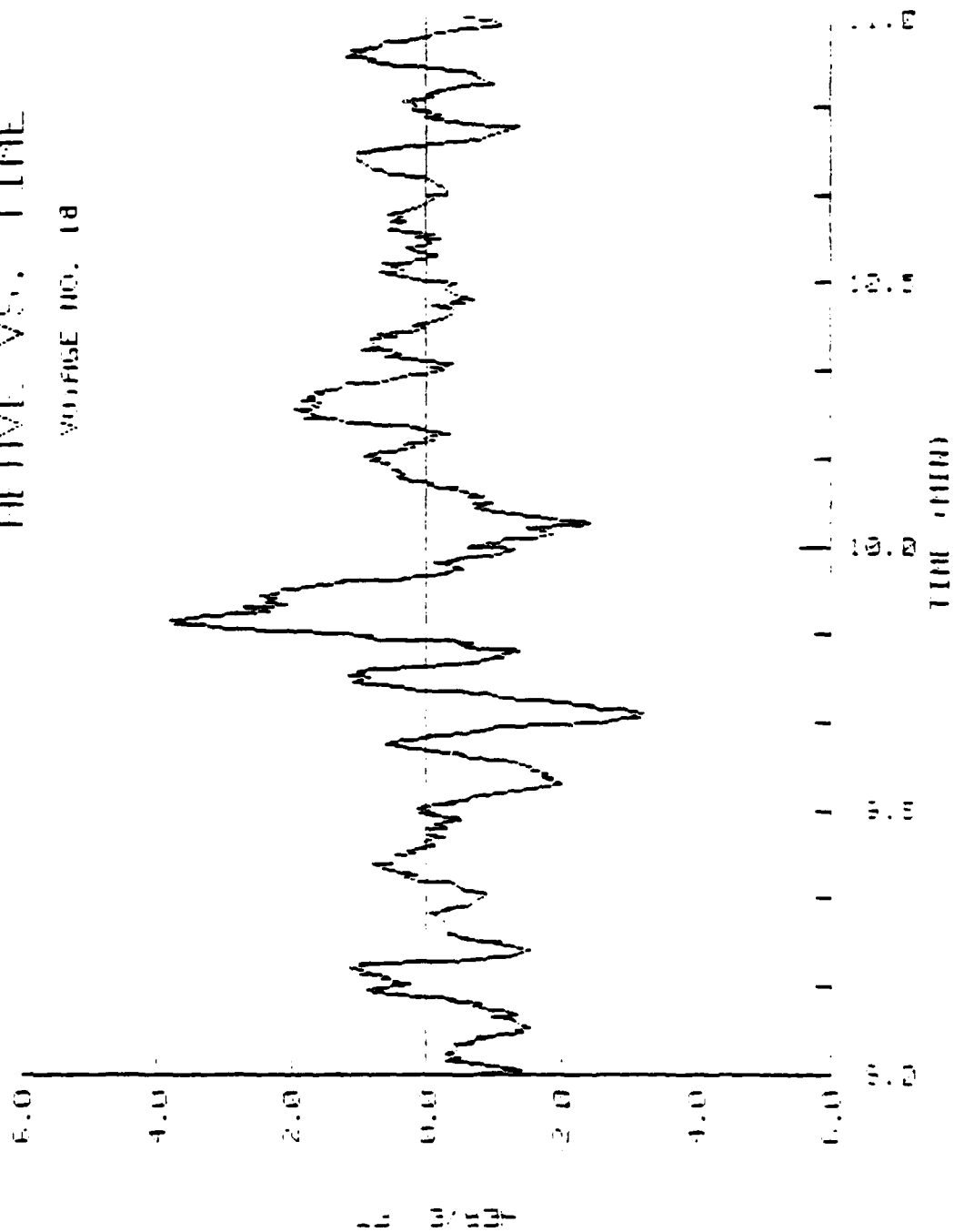
VOLTAGE NO. 18





# HEAVE VS. TIME

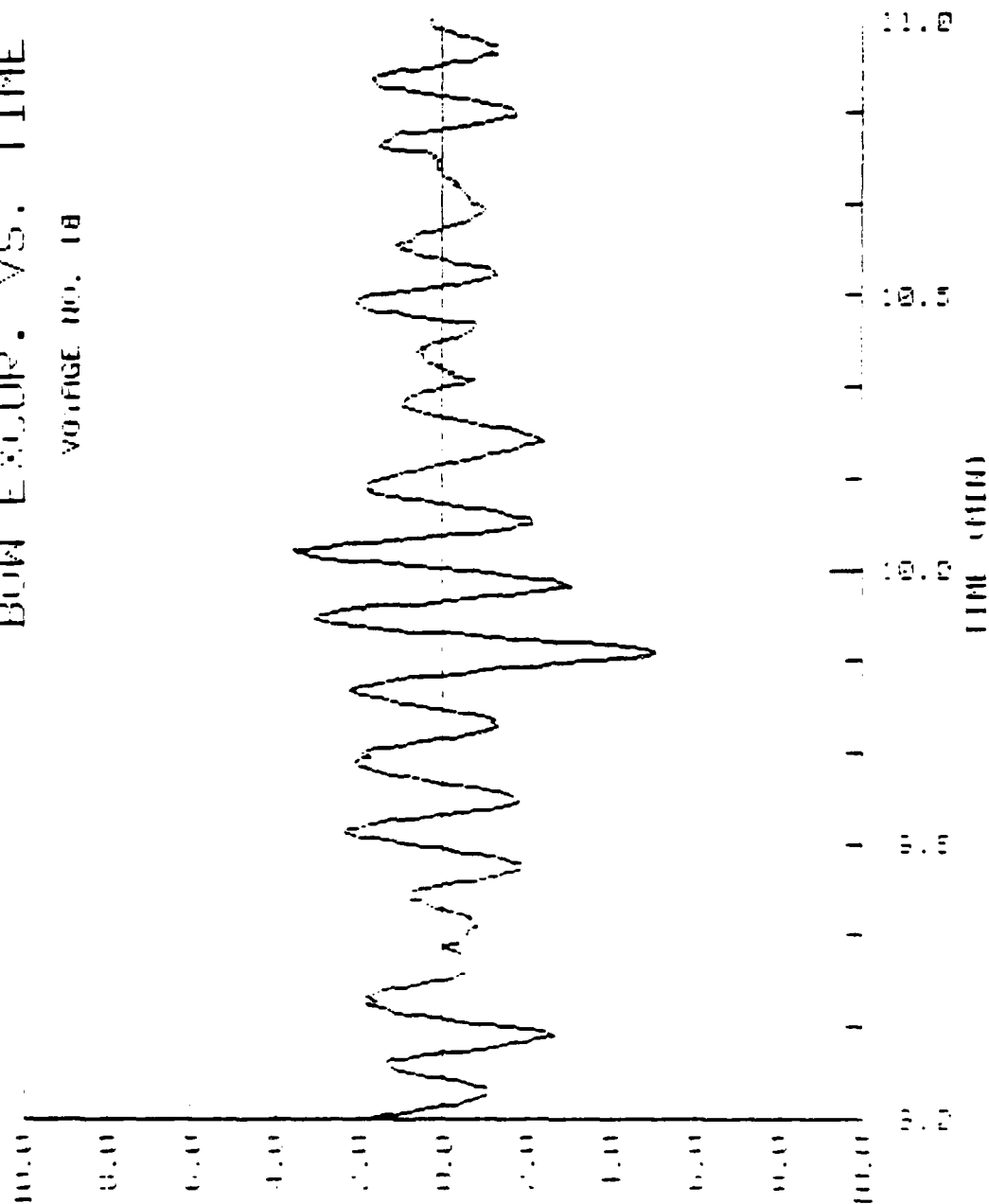
VOYAGE NO. 18





BUN EXCUR. VS. TIME

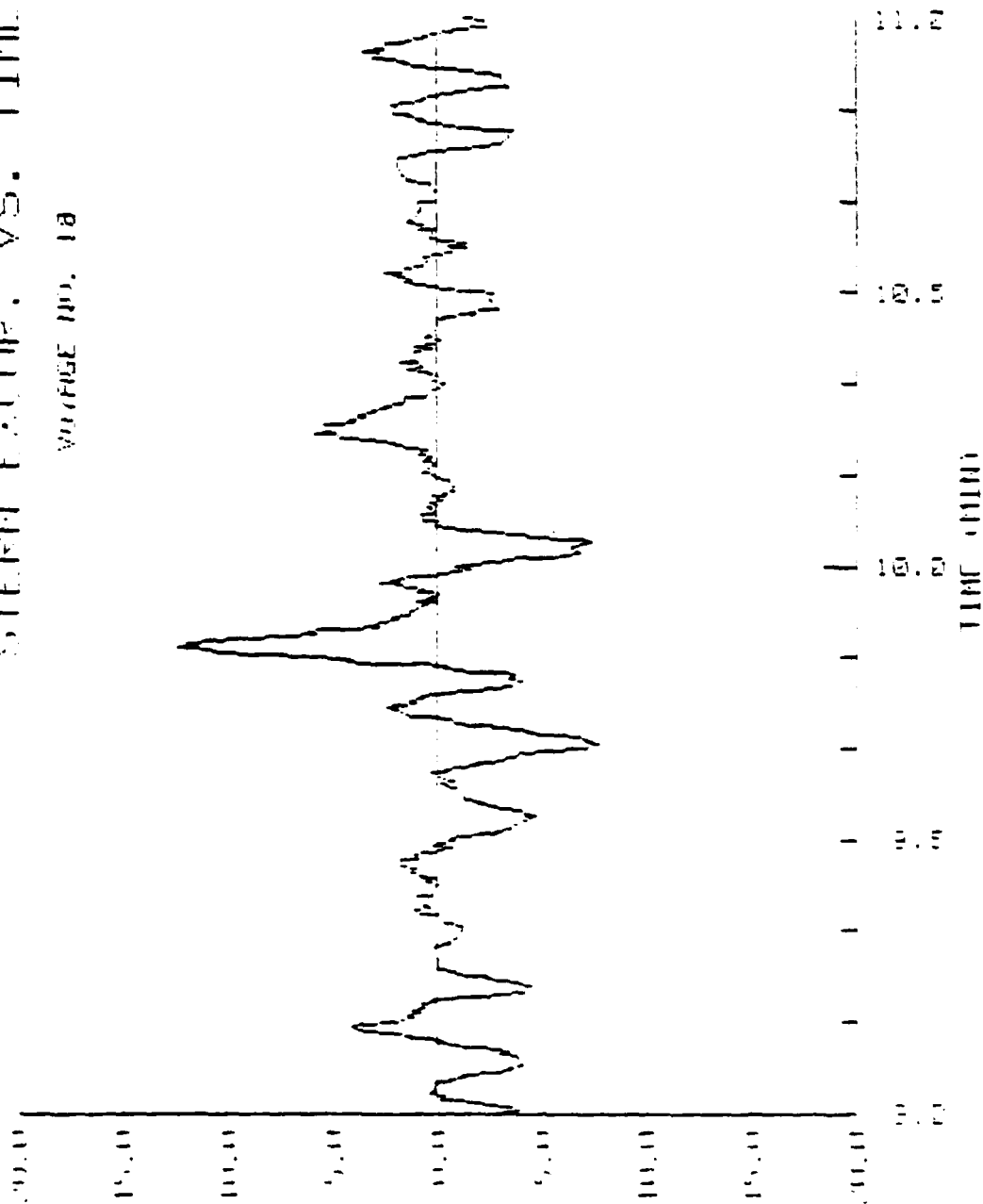
VOLUME NO. 18





BIERN EXCUR. VS. TIME

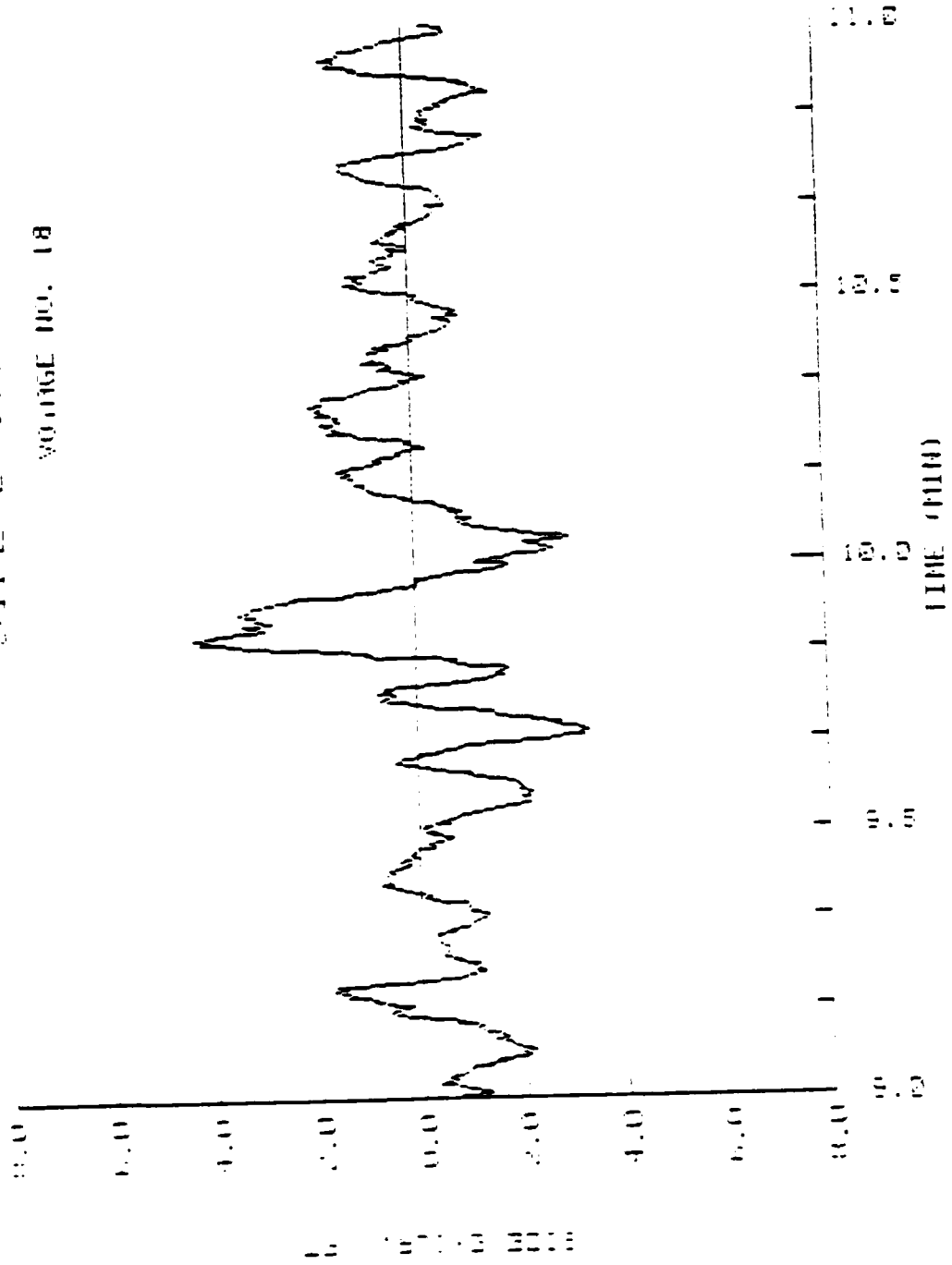
WAVE NO. 18





# SIDE ESCUP. VS. TIME

VOYAGE NO. 18





# STATISTICAL SUMMARY

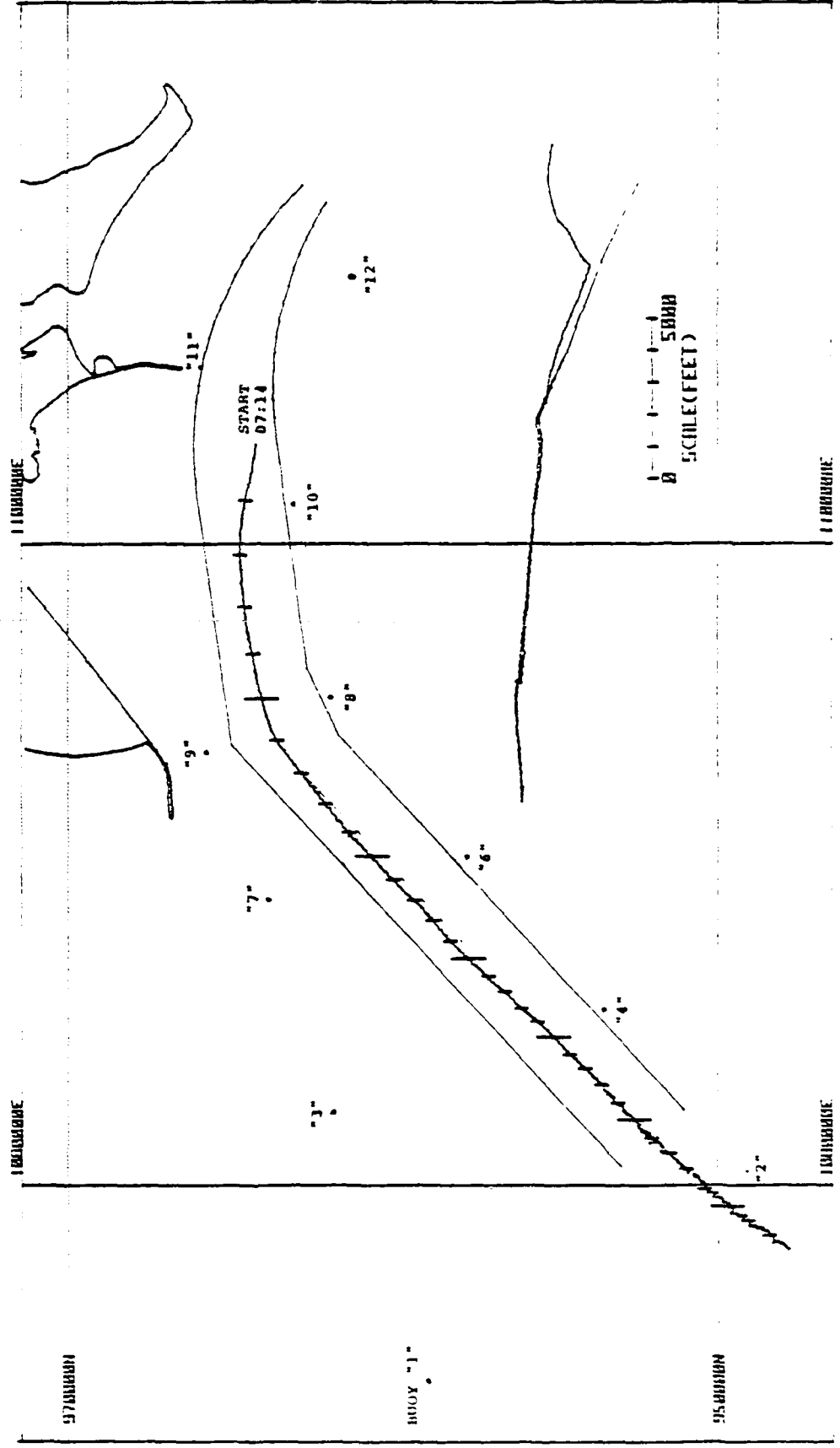
VOYAGE NO. 19

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.1	5.2	1.7	1.9
ROLL (DEG)	.5	14.5	4.4	5.4
YAW (FT/SEC/SEC)	-.0	9.3	2.6	3.1
HEAVE (FT)	.2	12.4	3.7	4.3
ROLL EXCUR. (FT)	.2	19.4	6.9	7.8
STEER EXCUR. (FT)	.2	38.3	10.8	12.6
SIDE EXCUR (FT)	.2	15.5	4.4	5.3



# VOYAGE NO. 19 SHIP TRACK

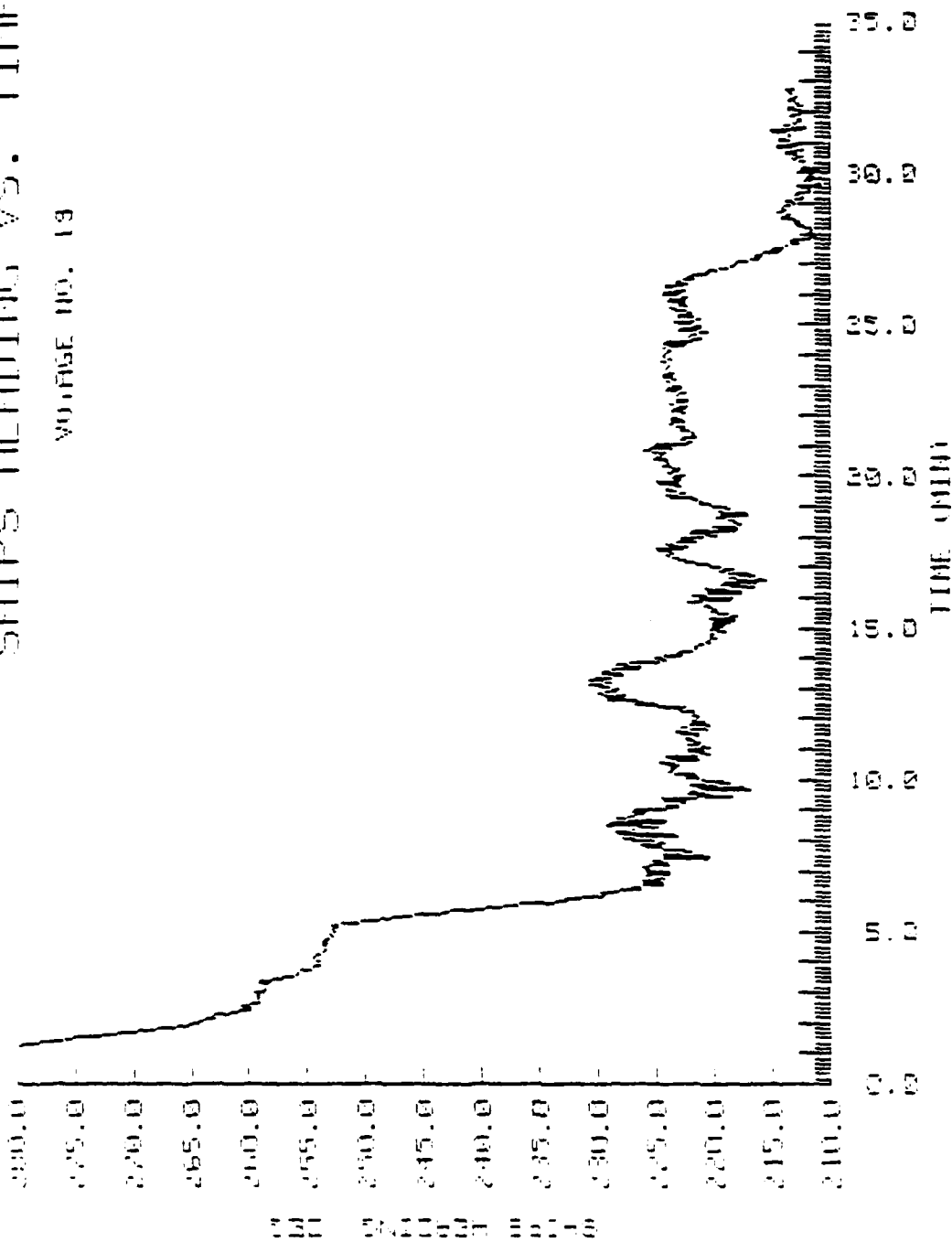
SCALE 1:50000





# SHIPS HEADING VS. TIME

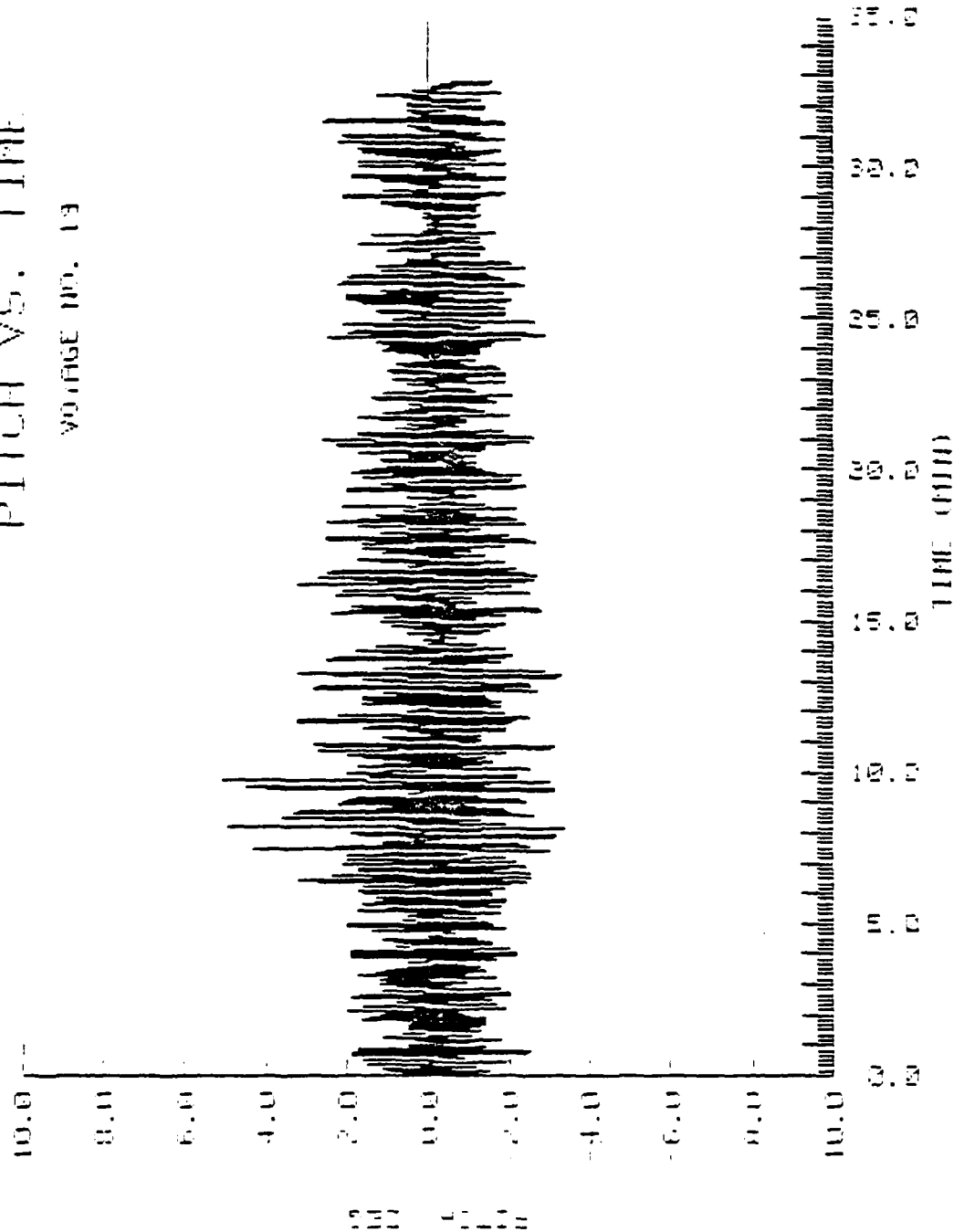
VOYAGE NO. 13





# PITCH VS. TIME

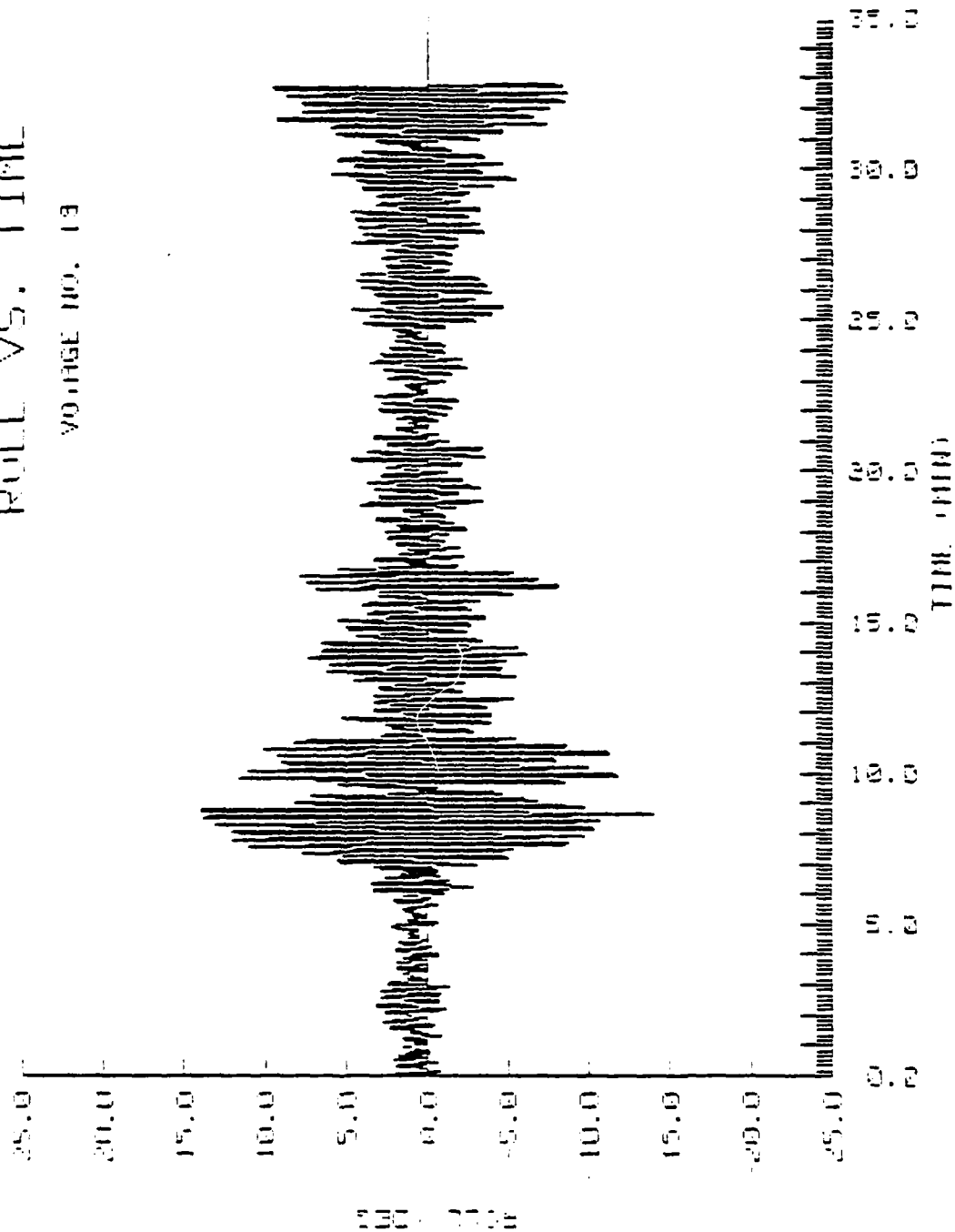
VOLUME NO. 13





# ROLL VS. TIME

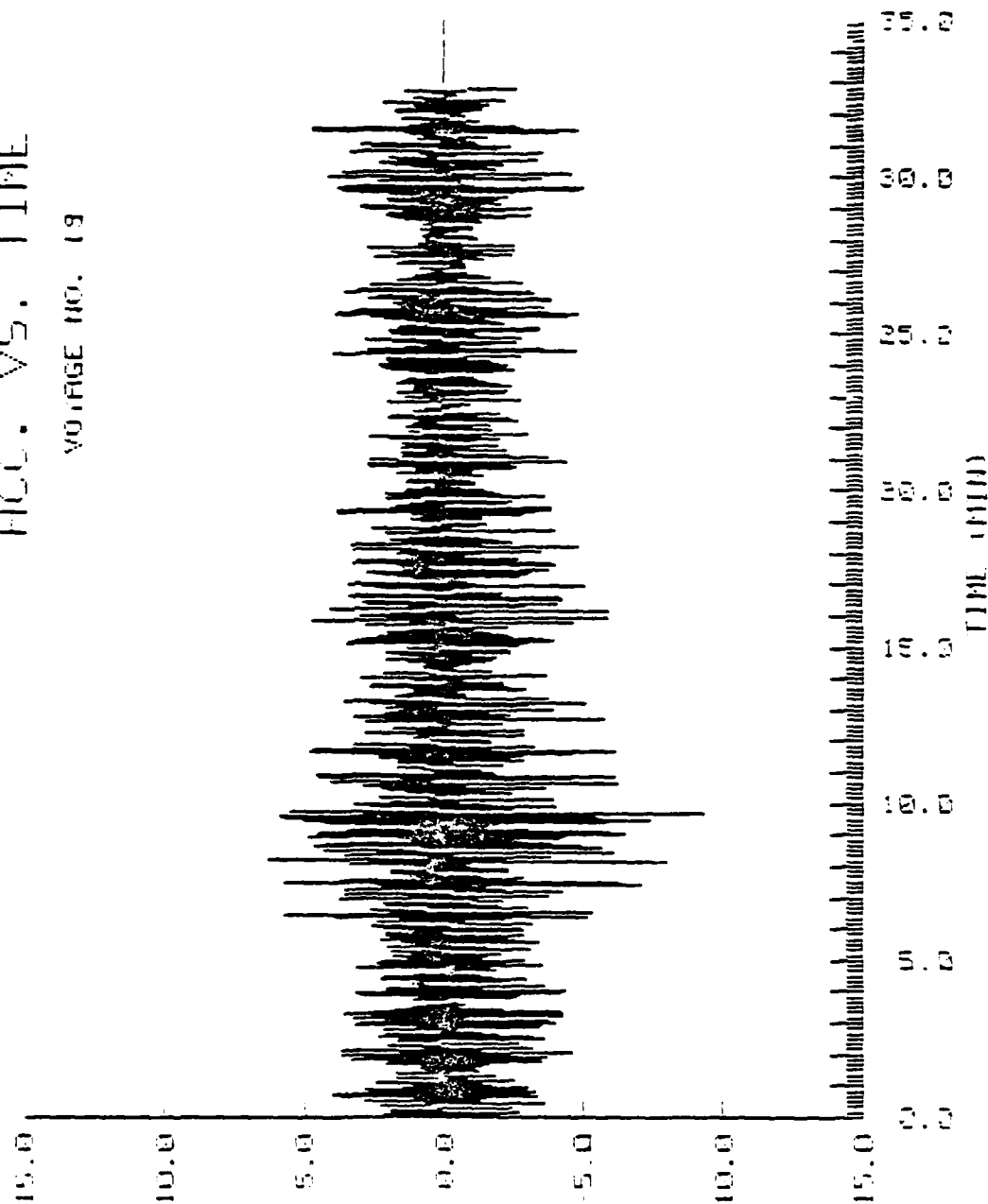
VOYAGE NO. 13





ACC. VS. TIME

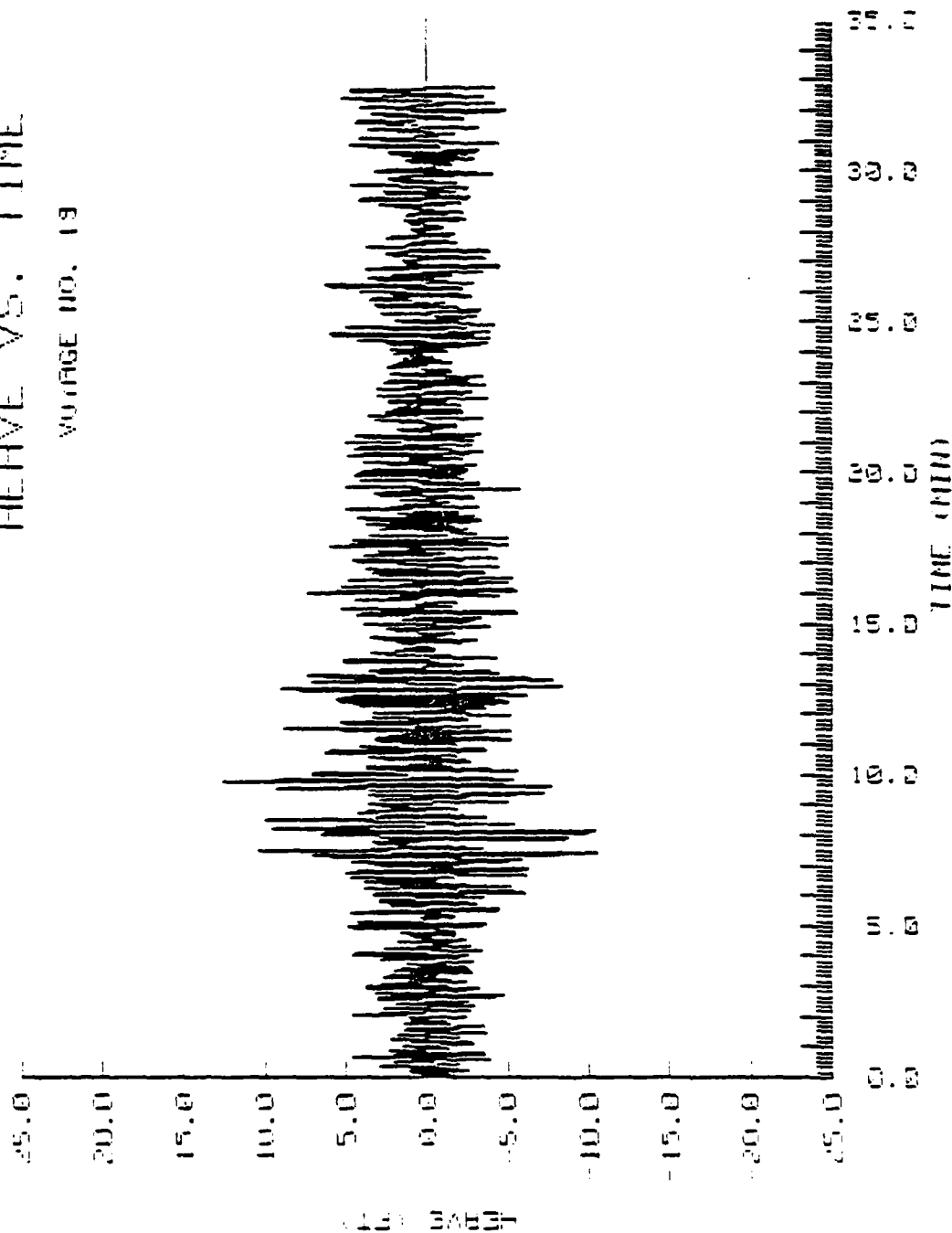
VOLUME NO. 19





# HERVE VS. TIME

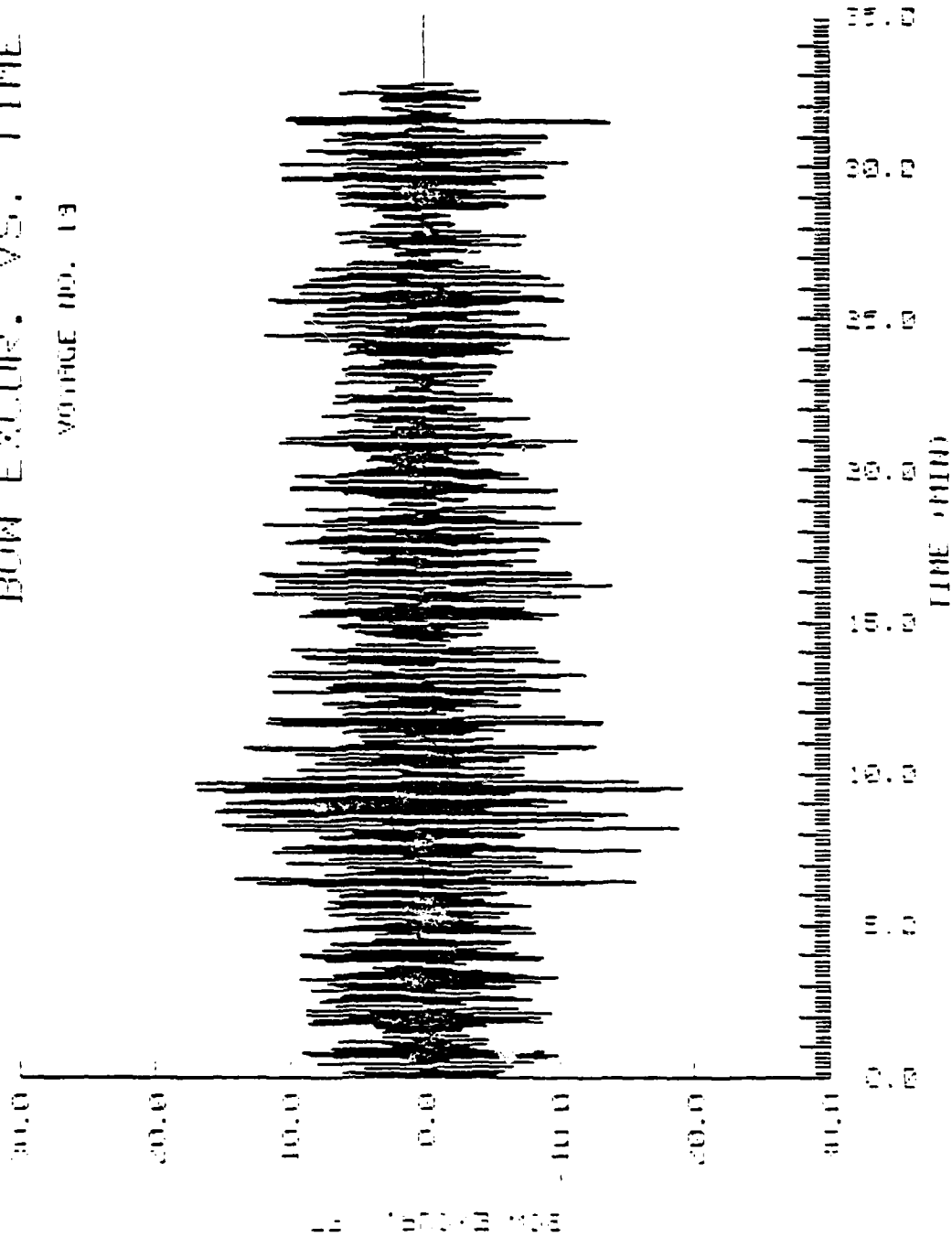
VOLUME NO. 13





# BOW EXCUR. VS. TIME

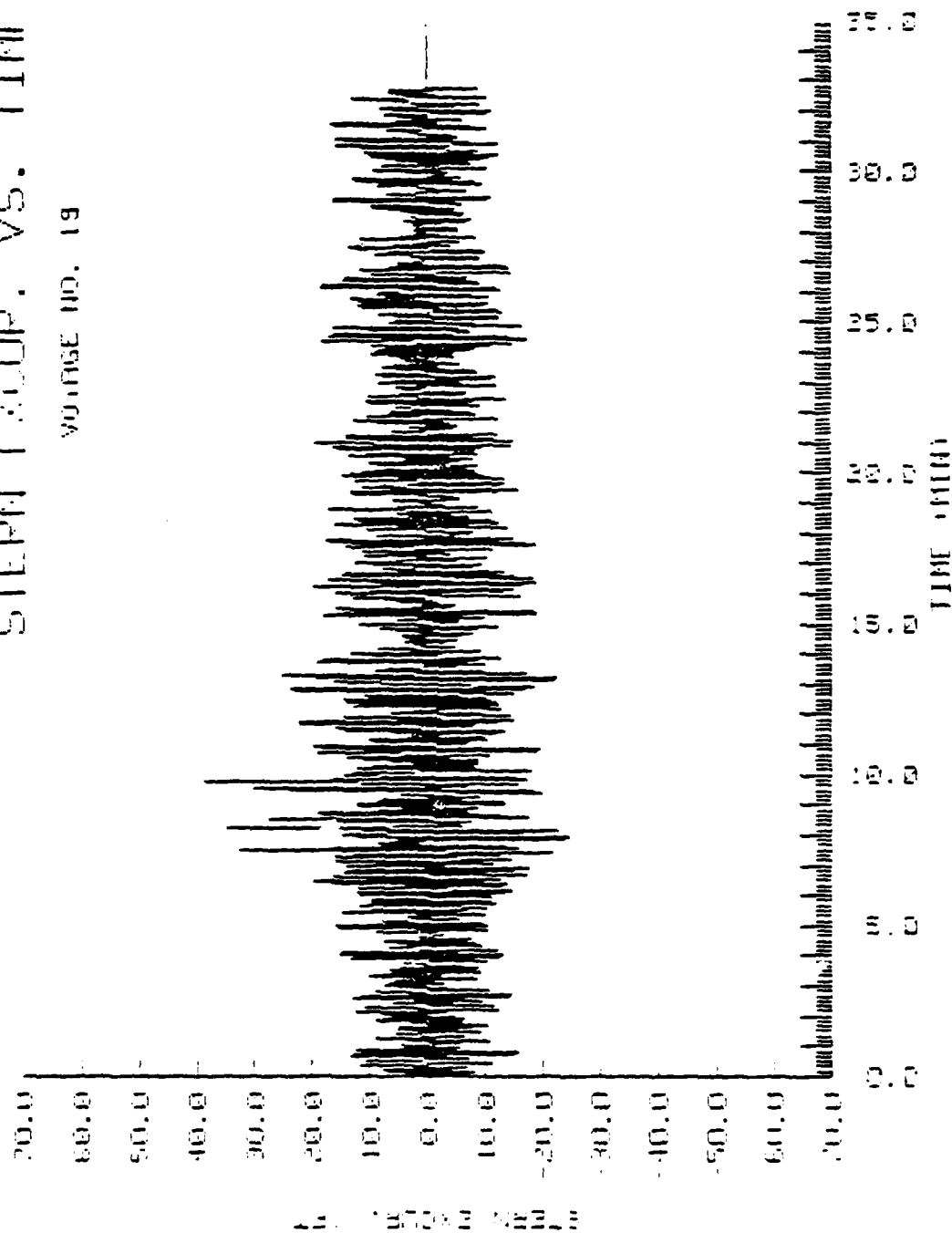
VOLUME NO. 13





# STEPN GROUP. VS. TIME

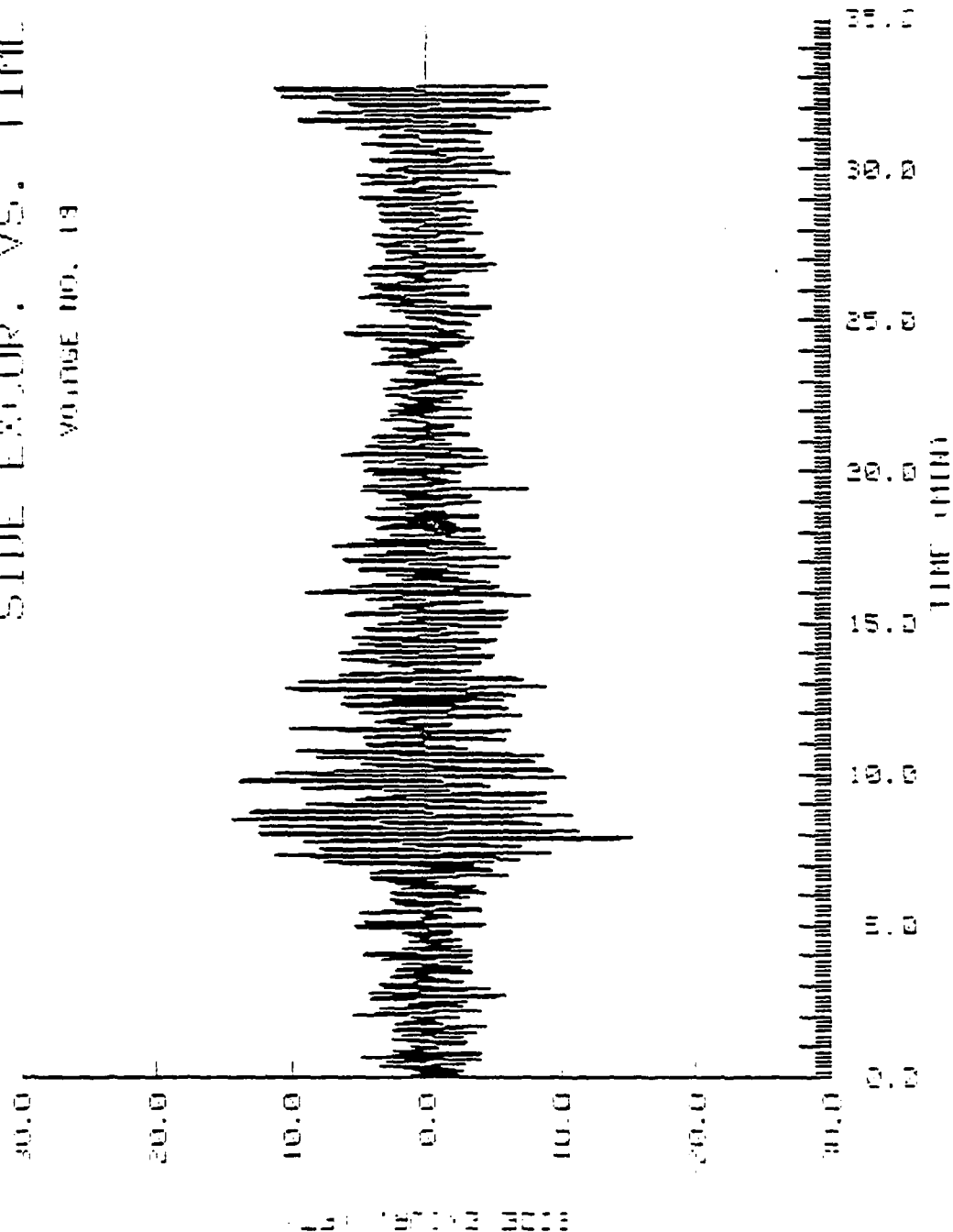
VOLUME NO. 19





# SIDE EXCUR. VS. TIME

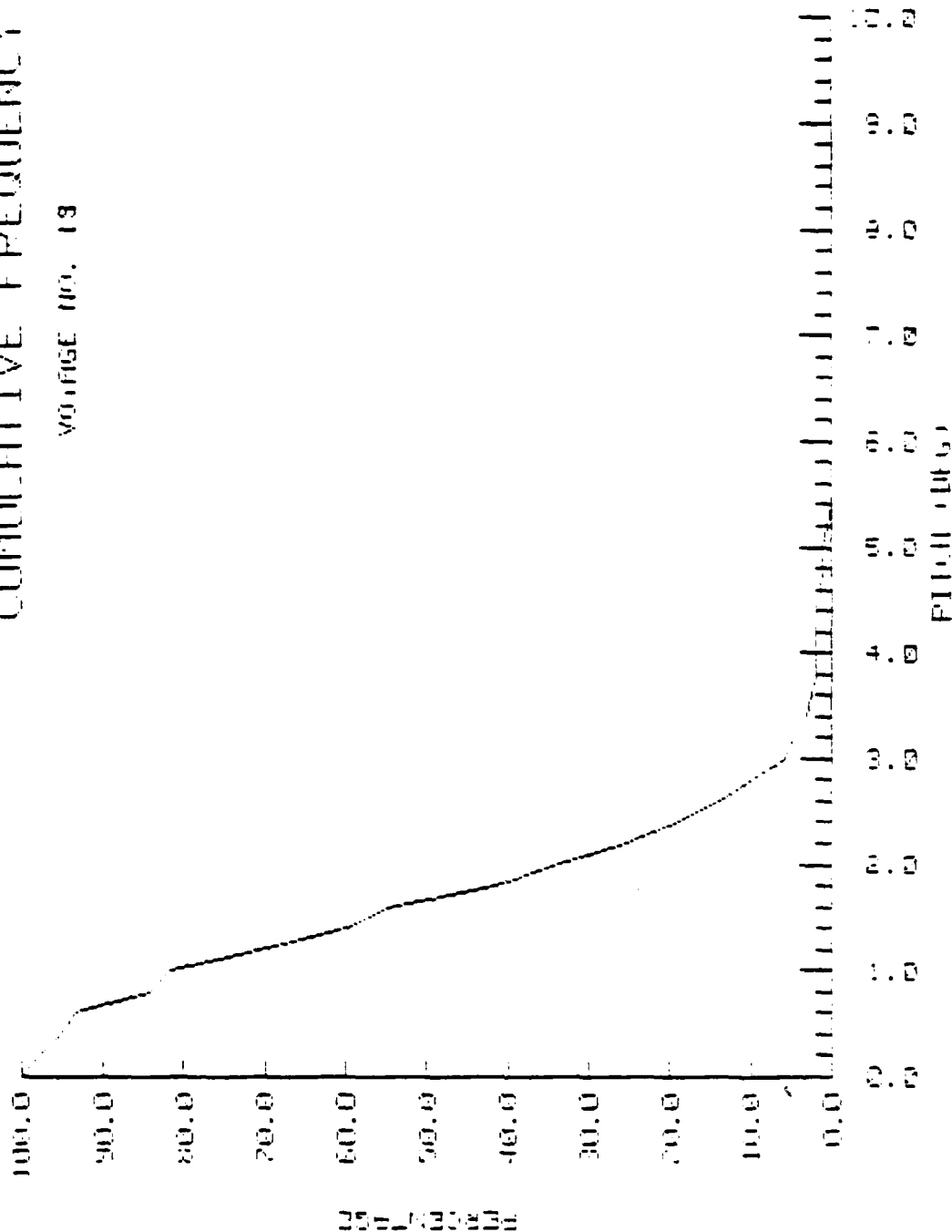
VOLUME NO. 13





# CUMULATIVE FREQUENCY

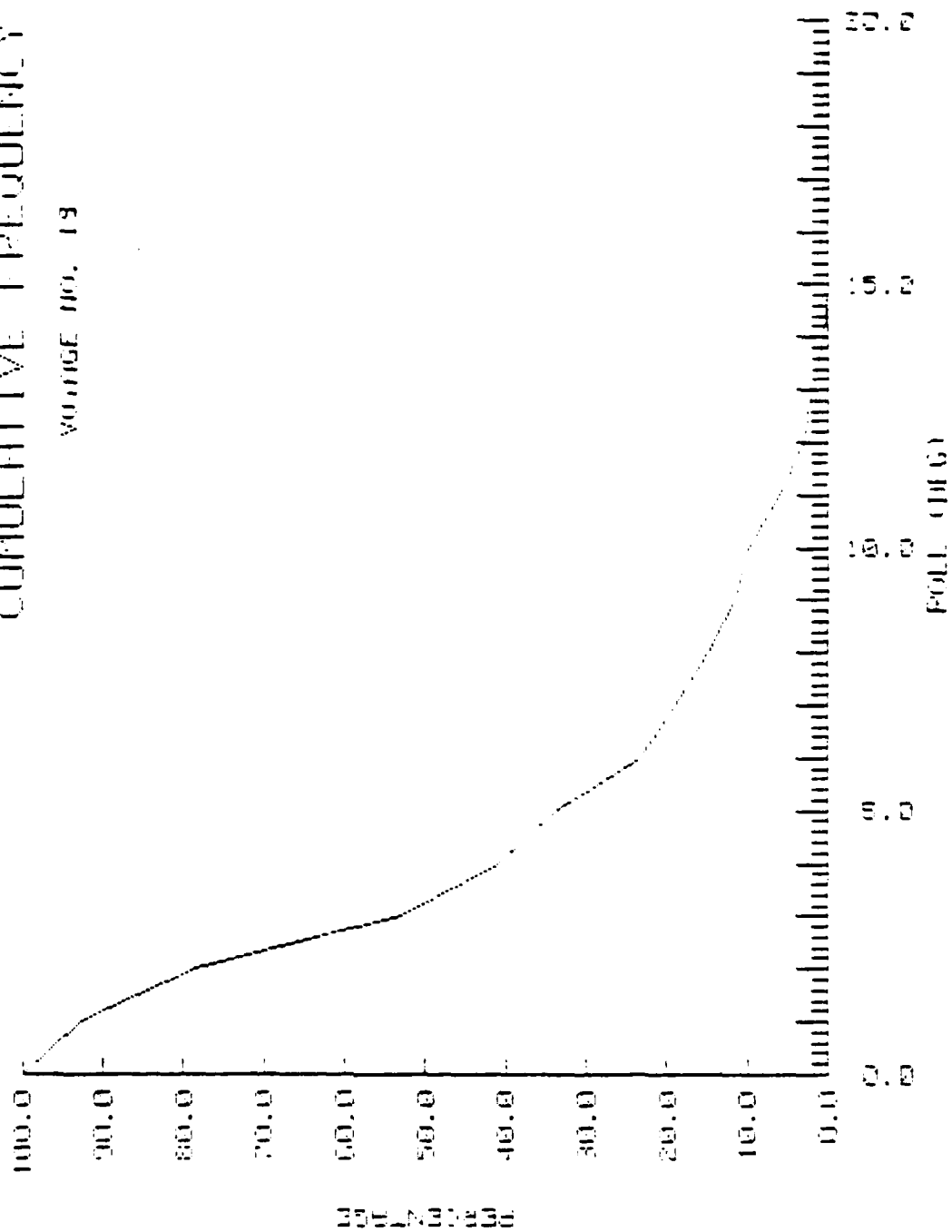
WAVE NO. 13





# CUMULATIVE FREQUENCY

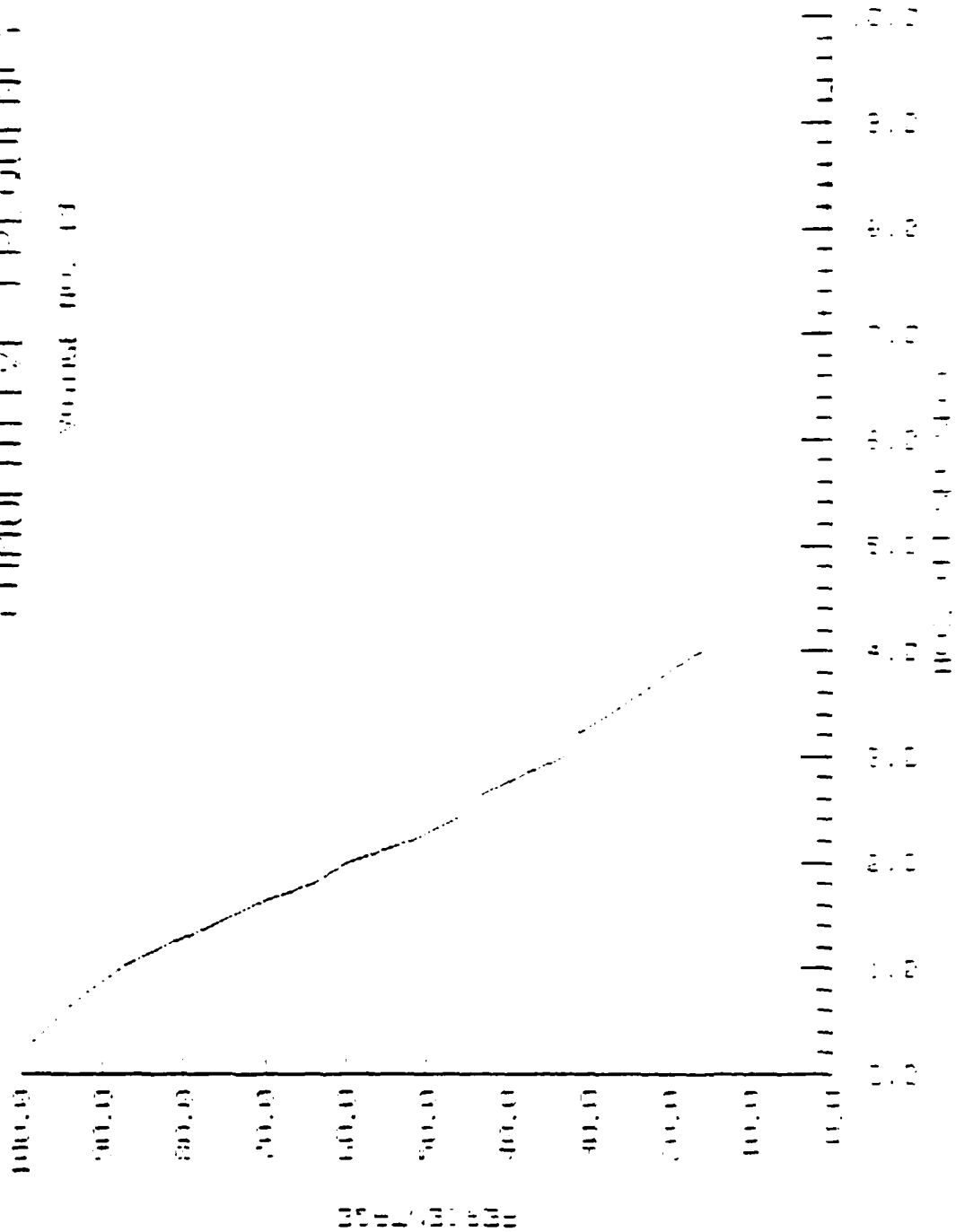
VOLUME NO. 19



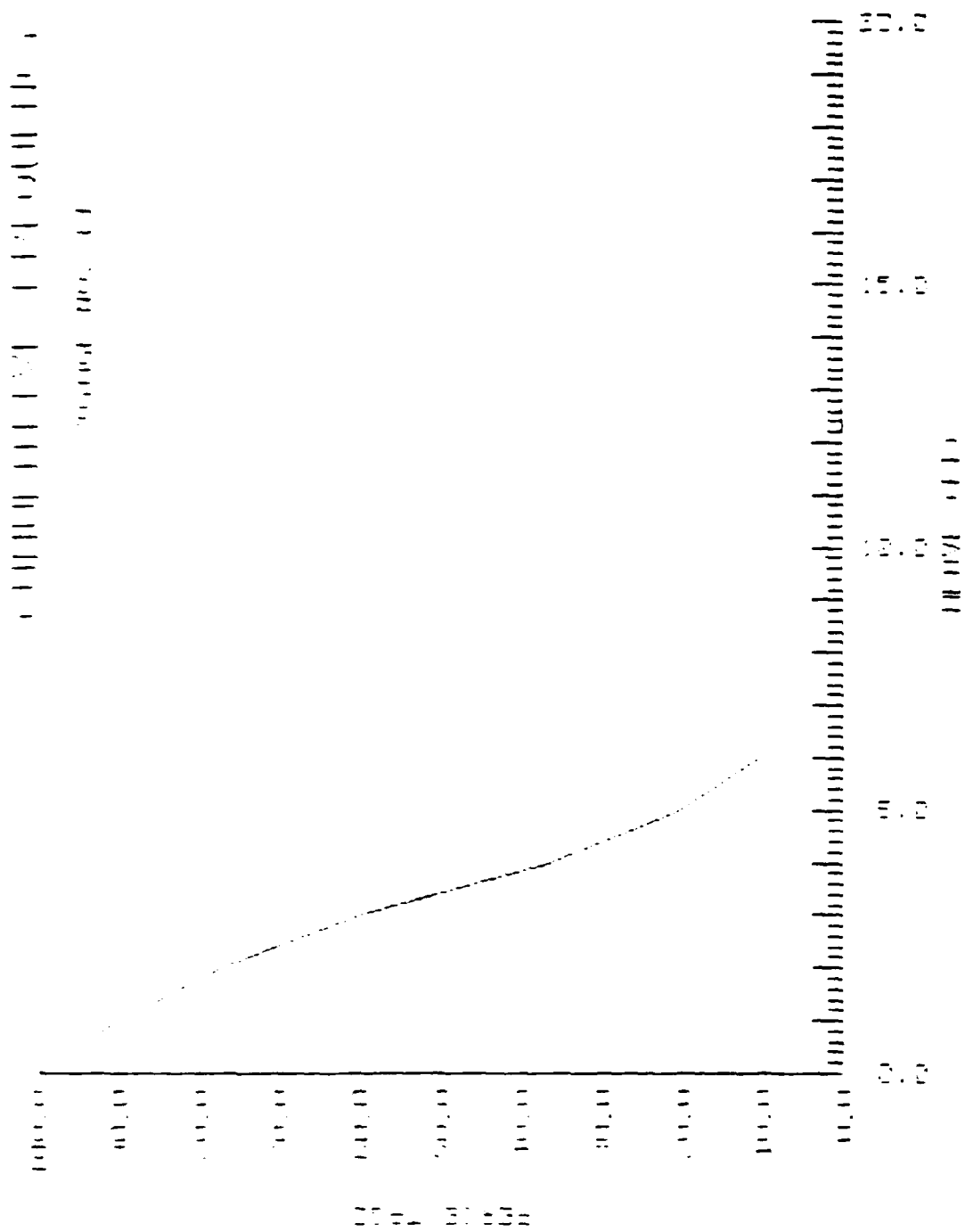


# CHROMIUM PLOT

Volume 100.0



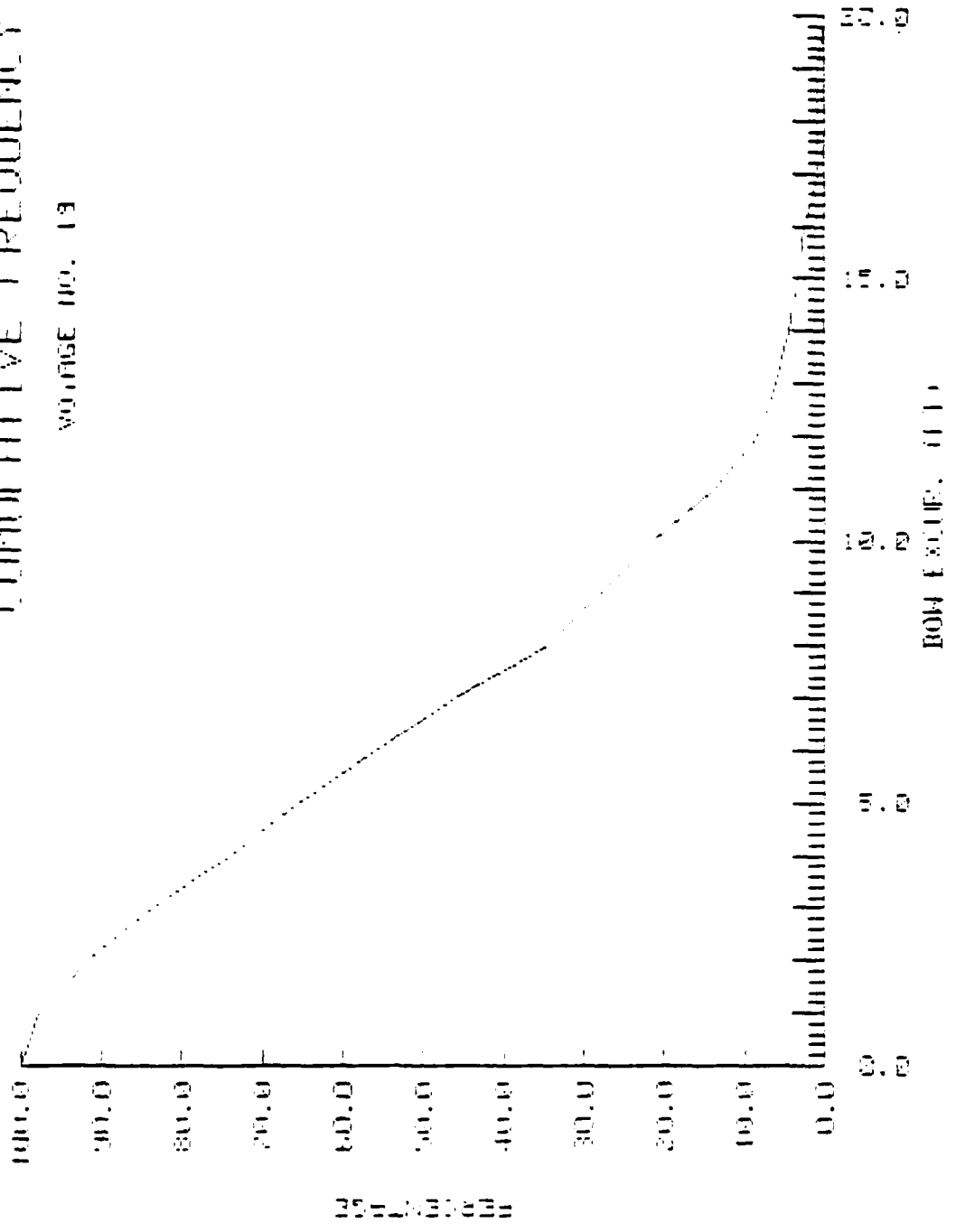






# CUMULATIVE FREQUENCY

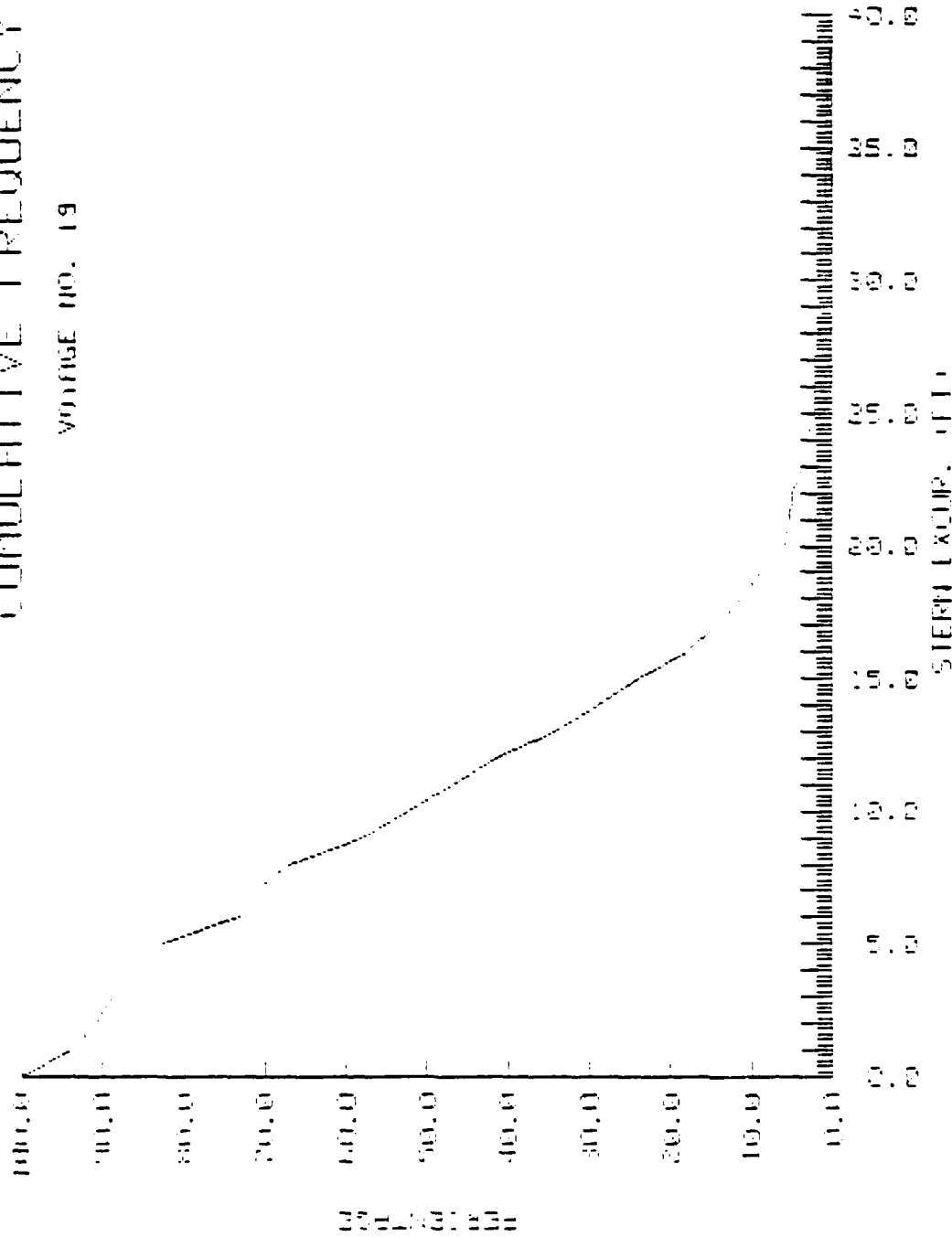
VOLUME NO. 13





# CUMULATIVE FREQUENCY

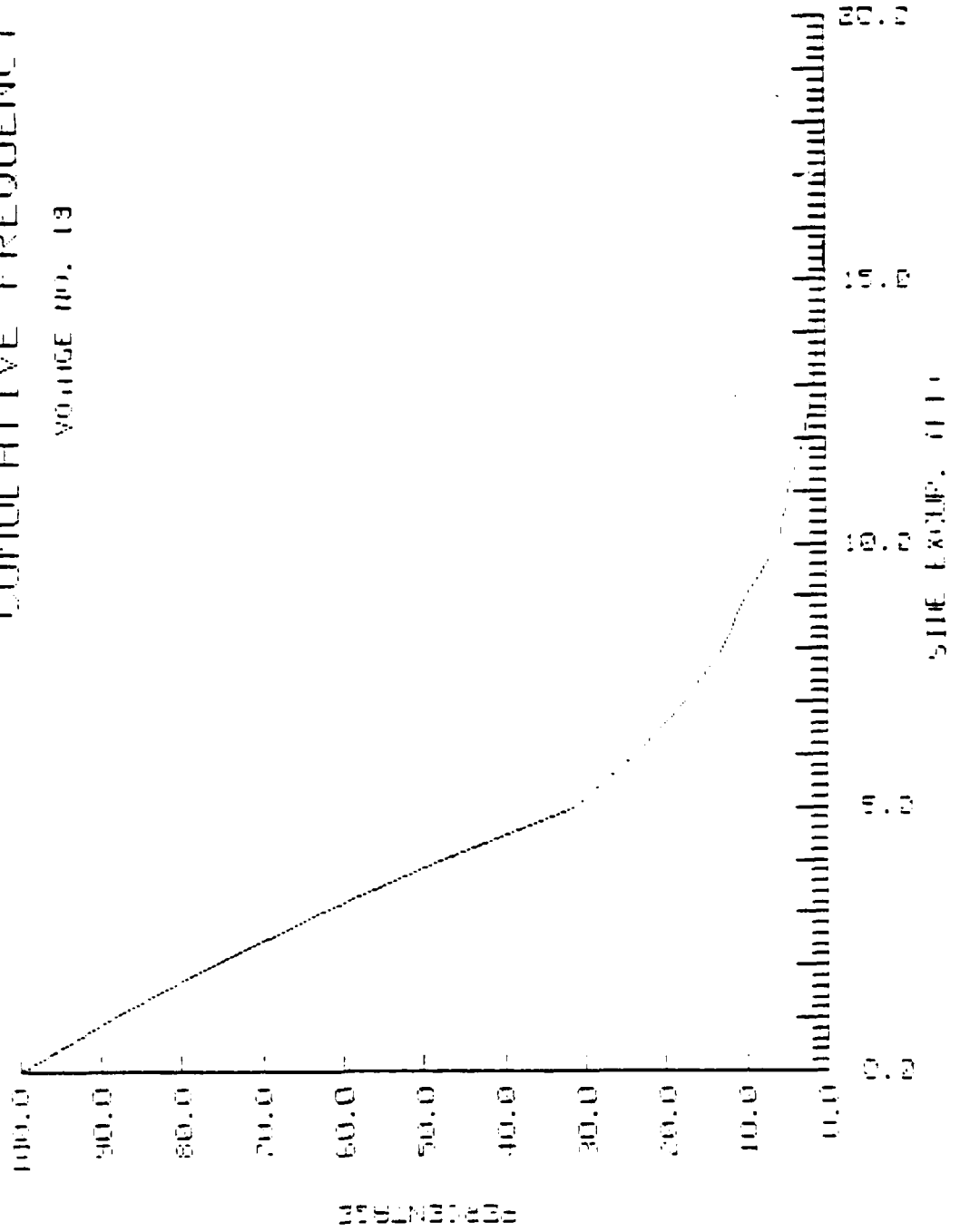
VOLUME NO. 19





# CUMULATIVE FREQUENCY

Y0105E 00. 13





# SOLPS HEADING VS. TIME

VOYAGE NO. 13

235.0

230.0

225.0

220.0

215.0

1000 0100035 000000

12.0

12.0

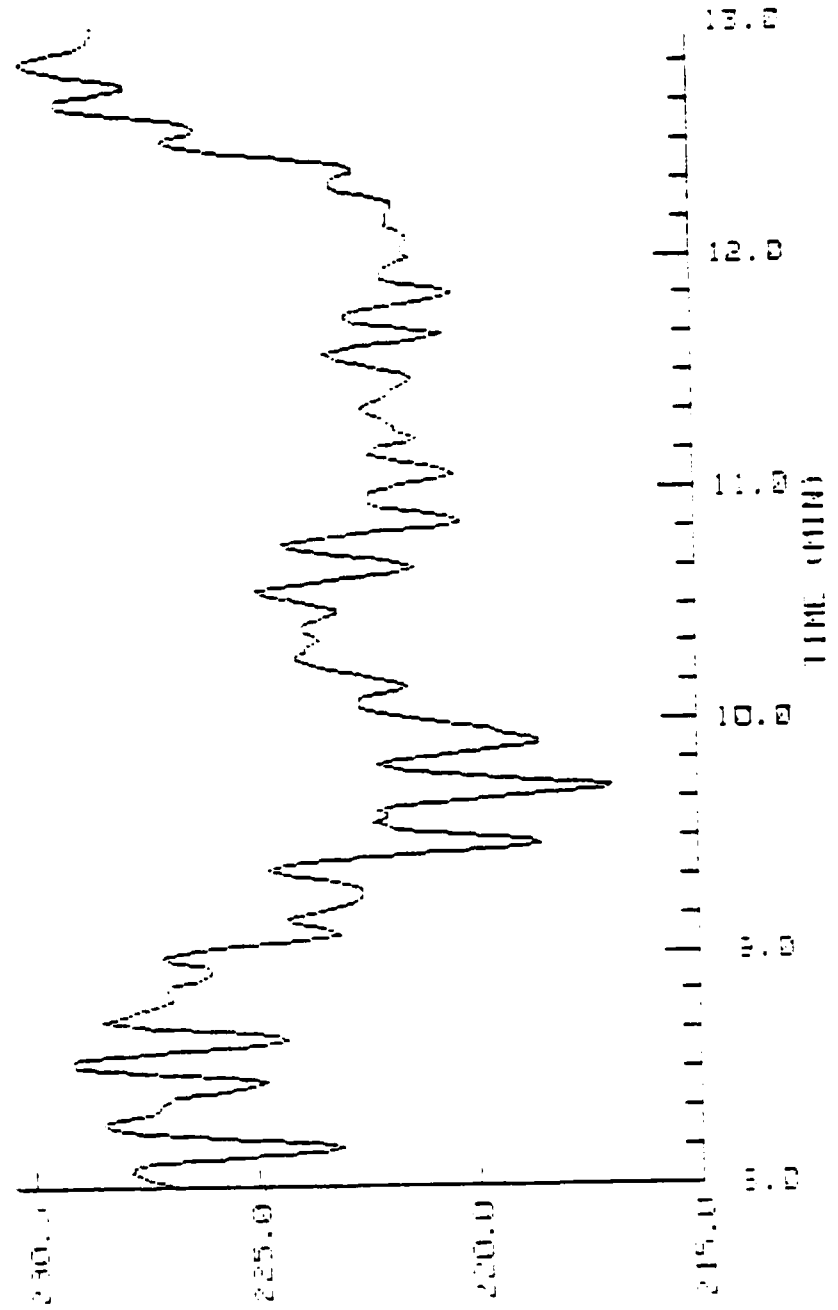
11.0

10.0

9.0

8.0

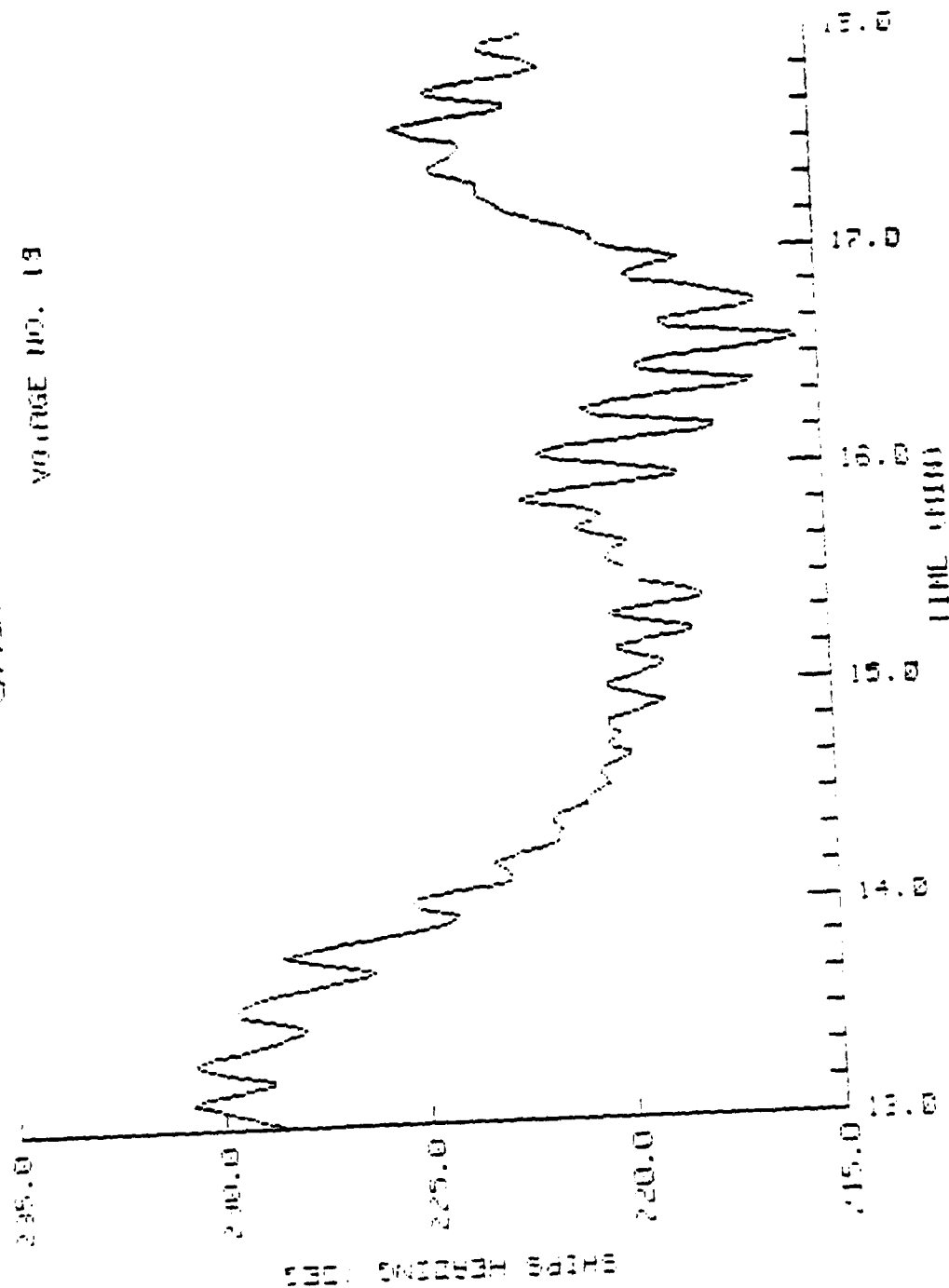
TIME (HRS)





# SHIPS HEADING VS. TIME

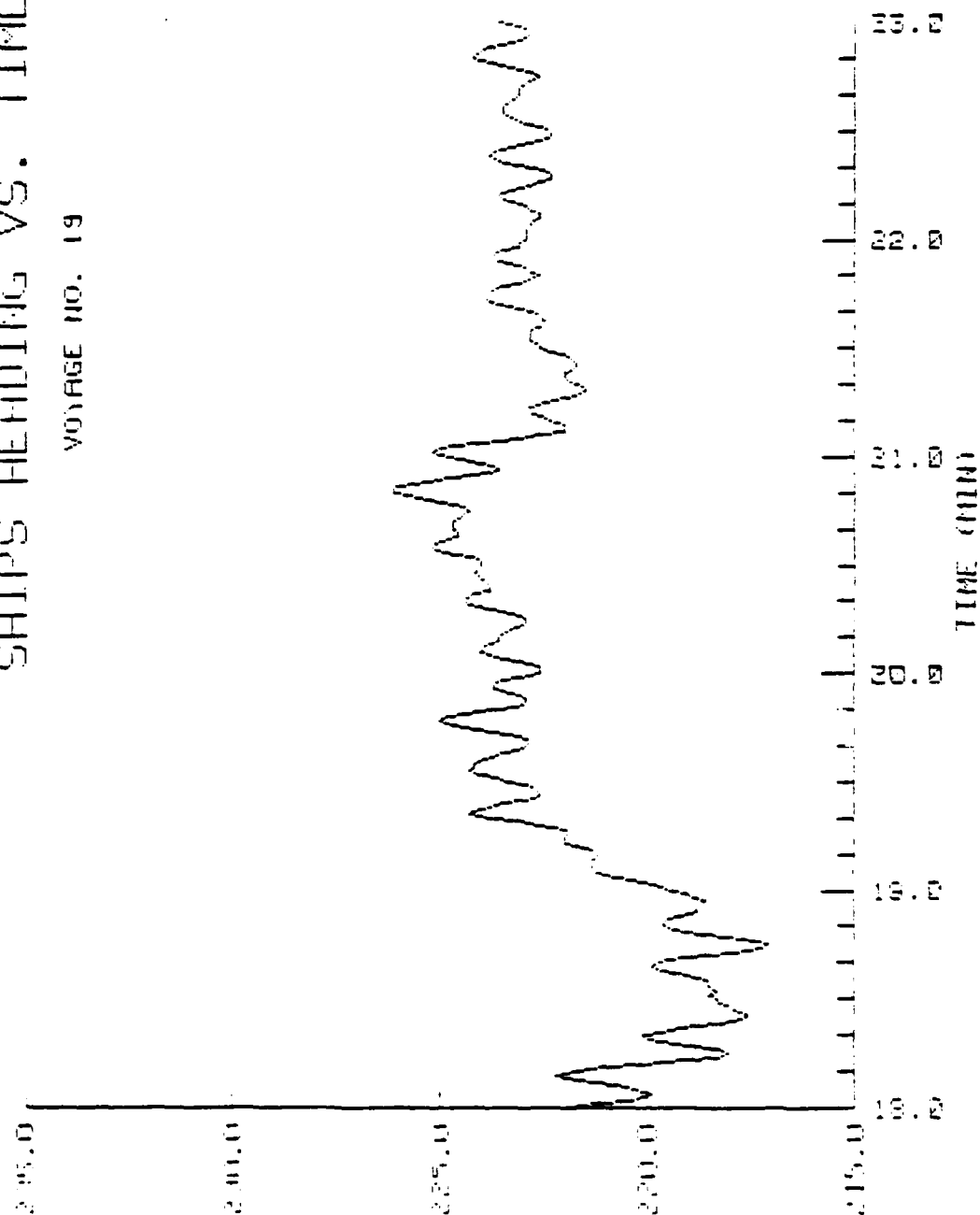
VOYAGE NO. 13





# SHIPS HEADING VS. TIME

VOYAGE NO. 19

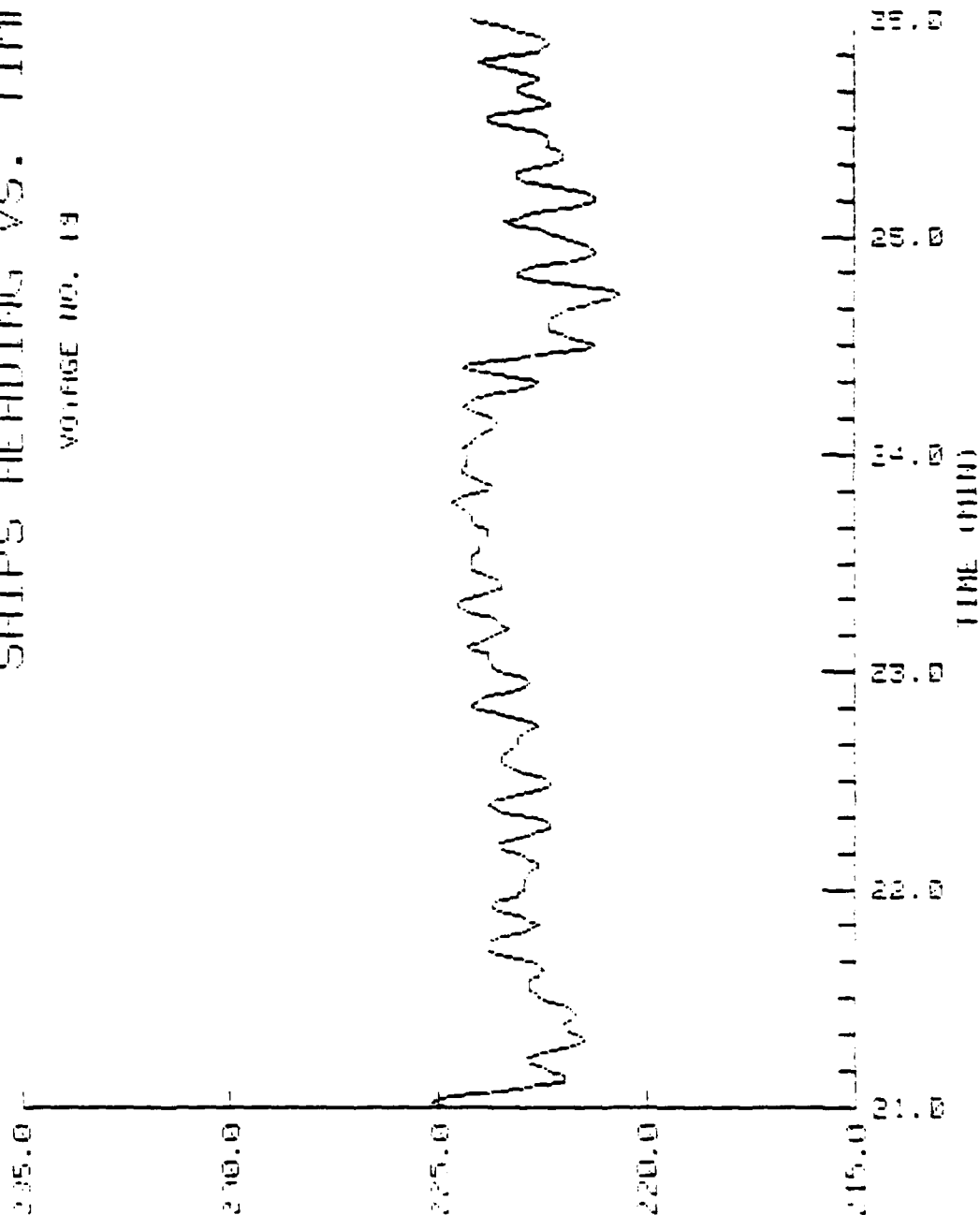


100 200 300 400 500 600 700 800 900 1000



# SHIPS HEADING VS. TIME

VOYAGE NO. 19

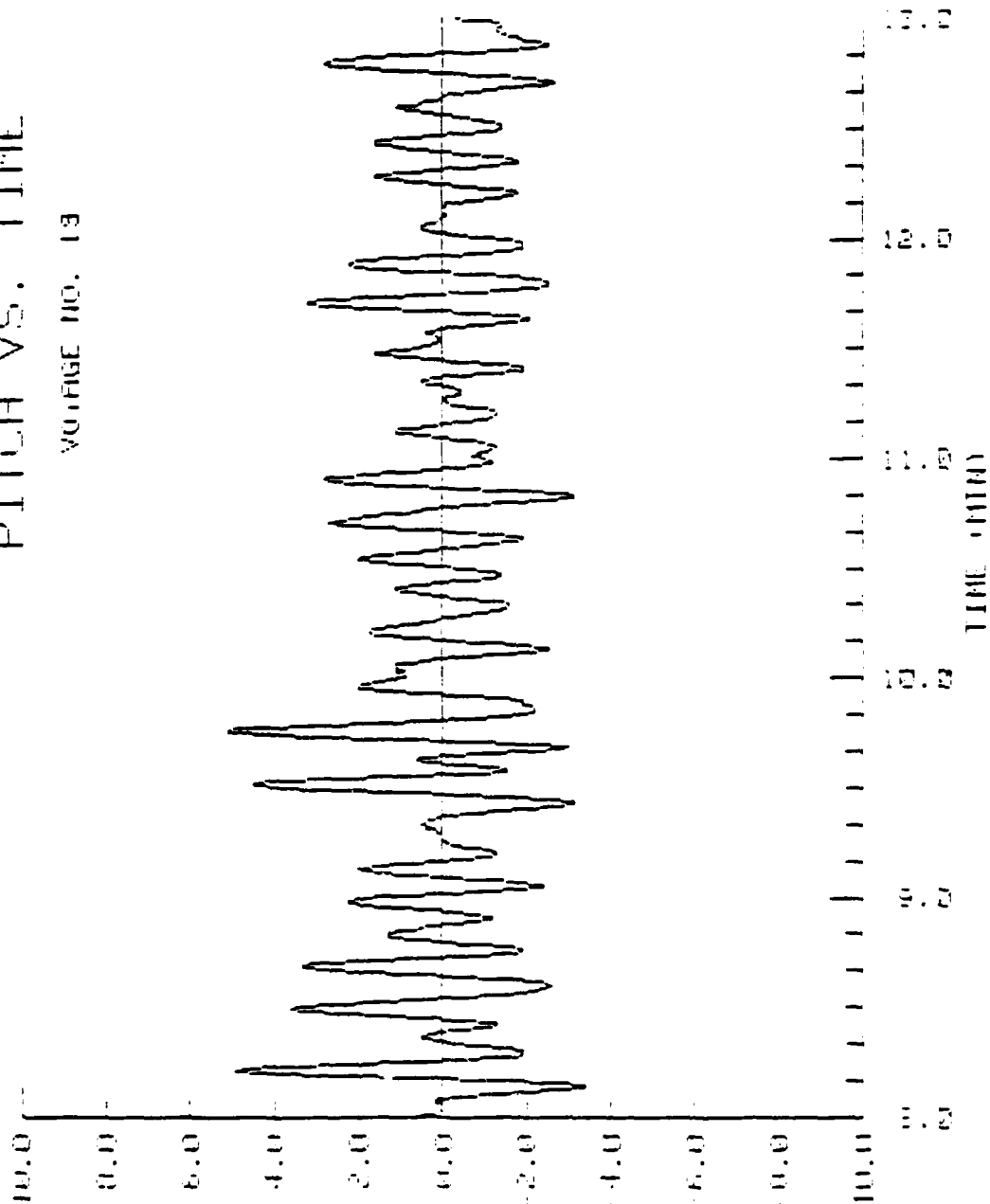


1000 000000 000000



# PITCH VS. TIME

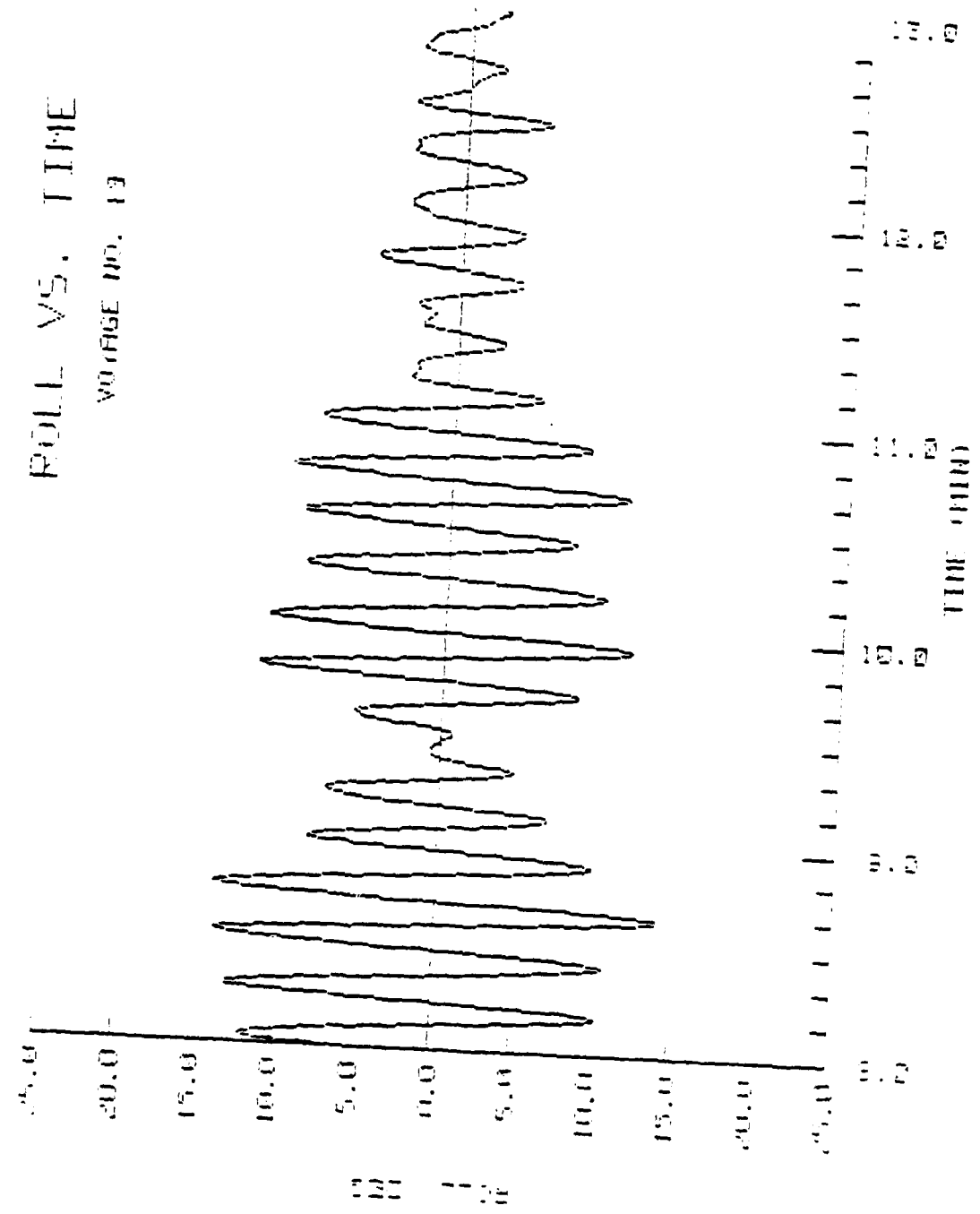
VOLUME NO. 13





# ROLL VS. TIME

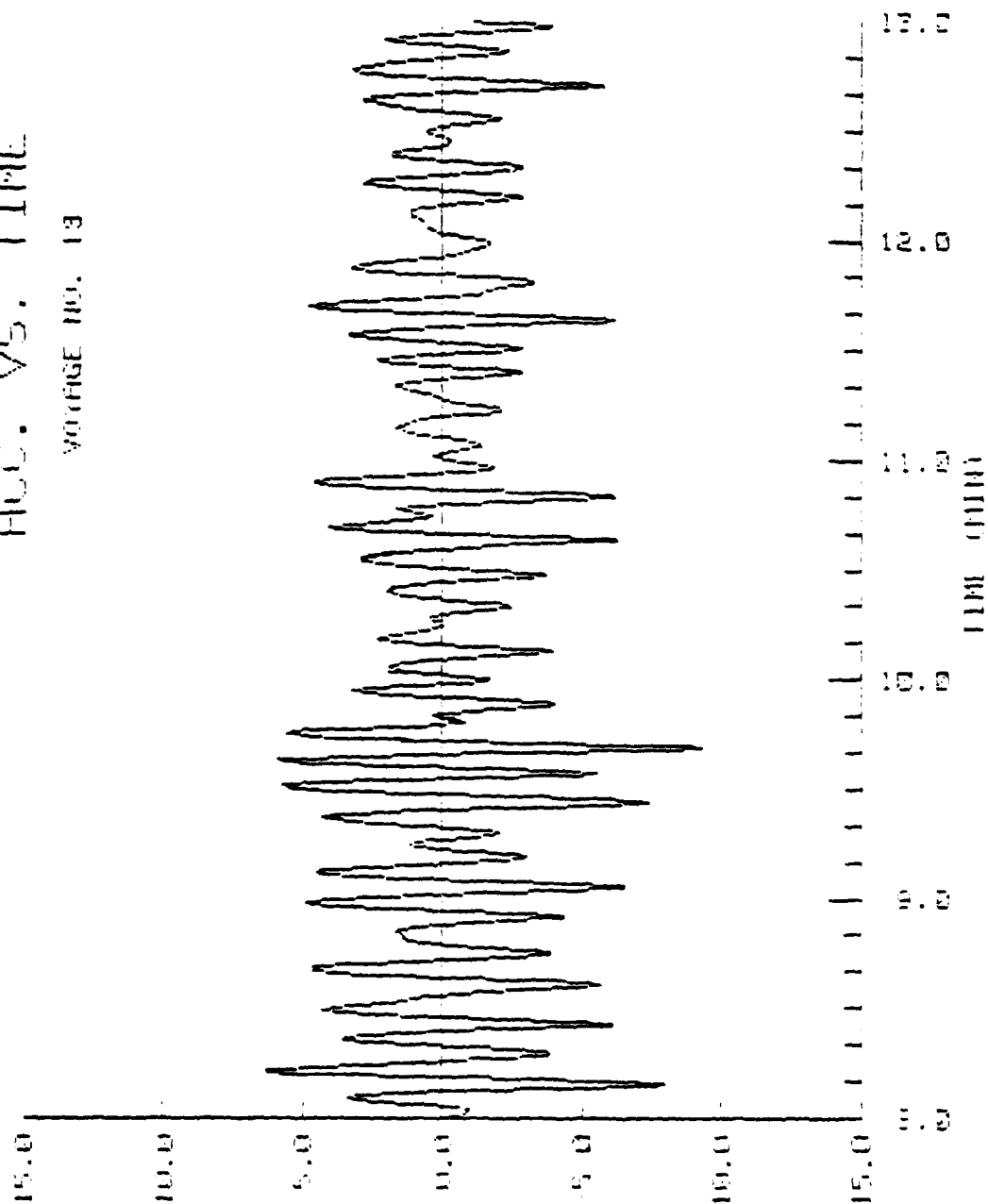
VORAGE NO. 13





# REC. VS. TIME

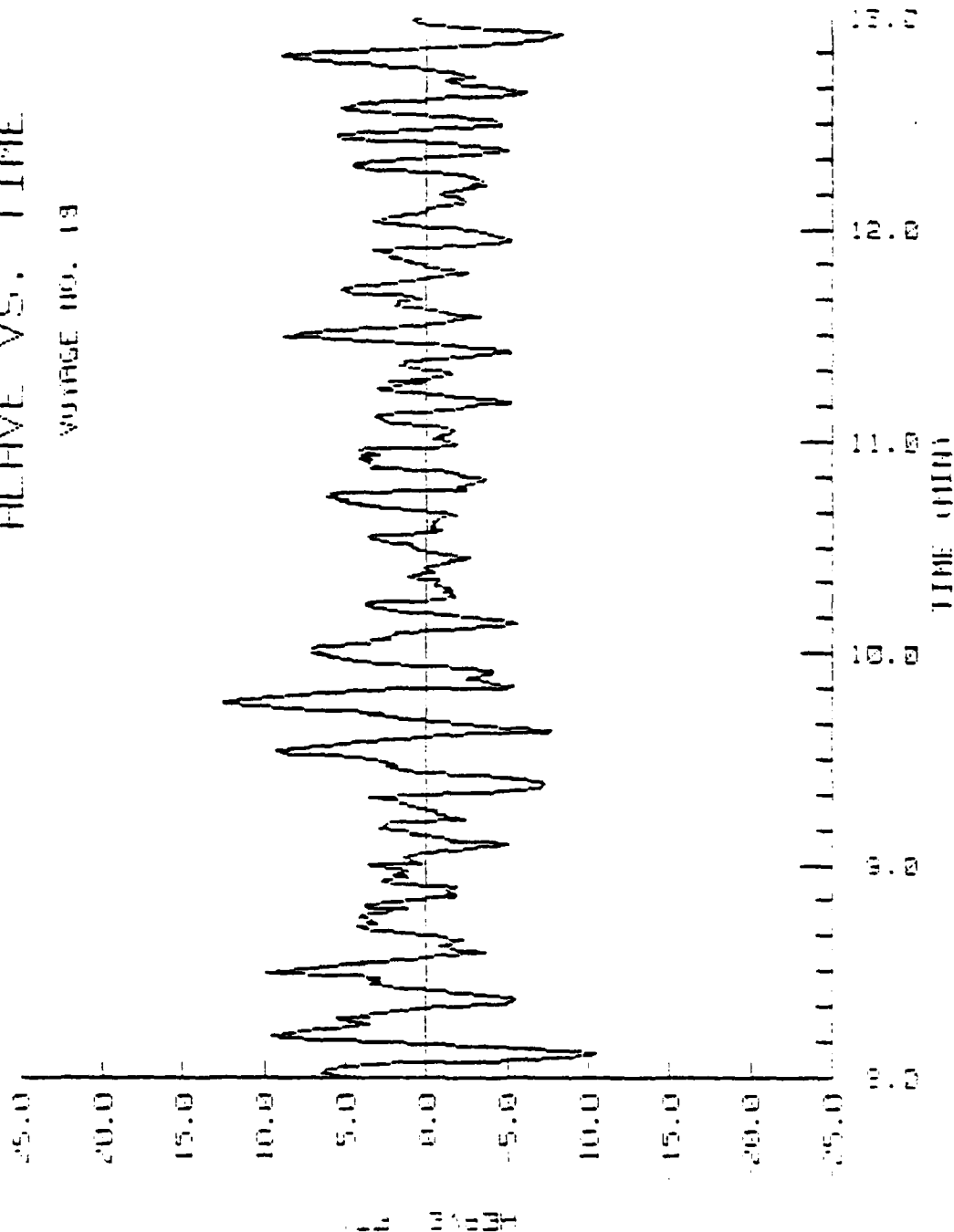
VOLUME NO. 13





# HEAVE VS. TIME

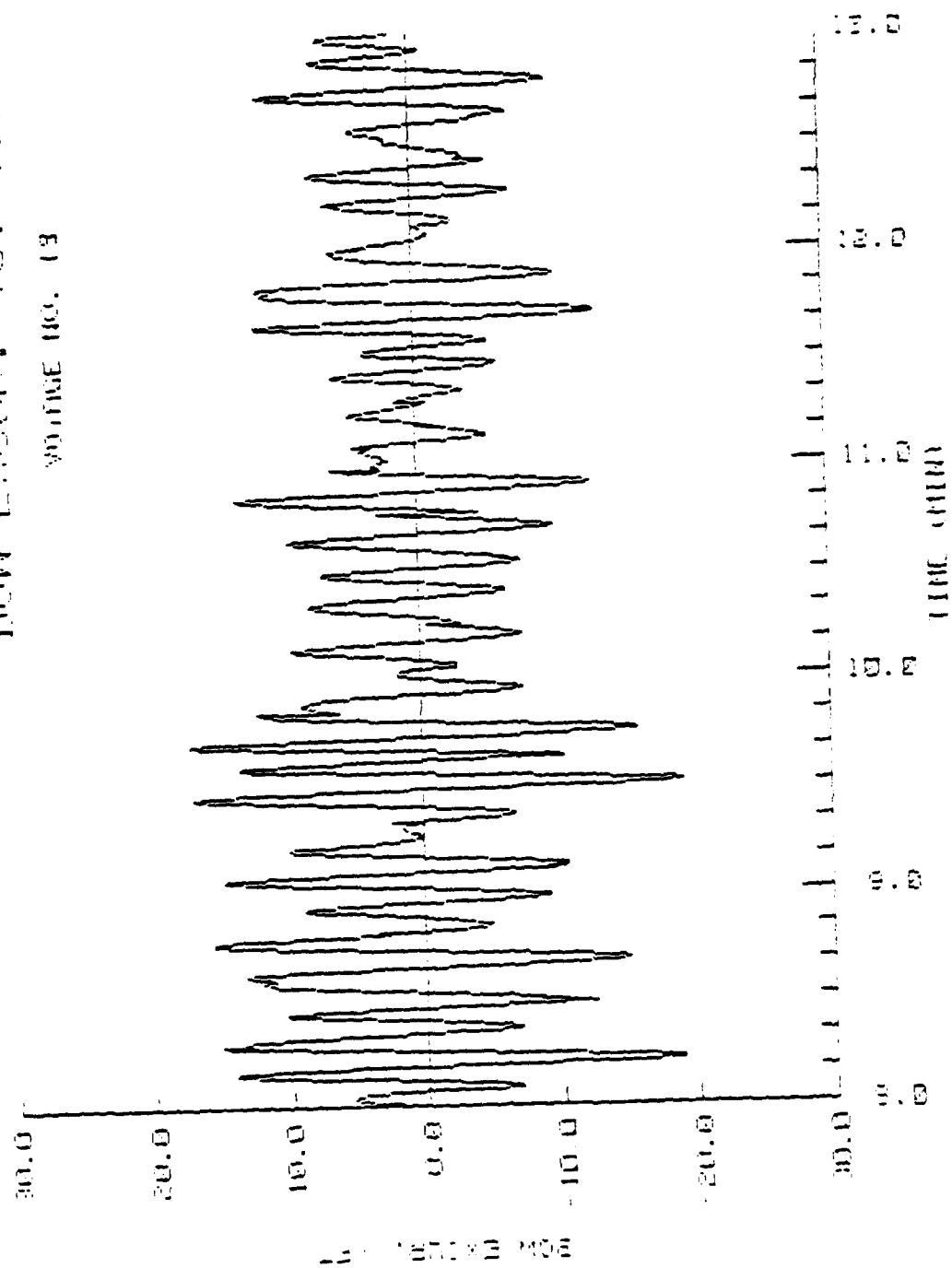
VOTAGE NO. 13





# ROM EXCUR. VS. TIME

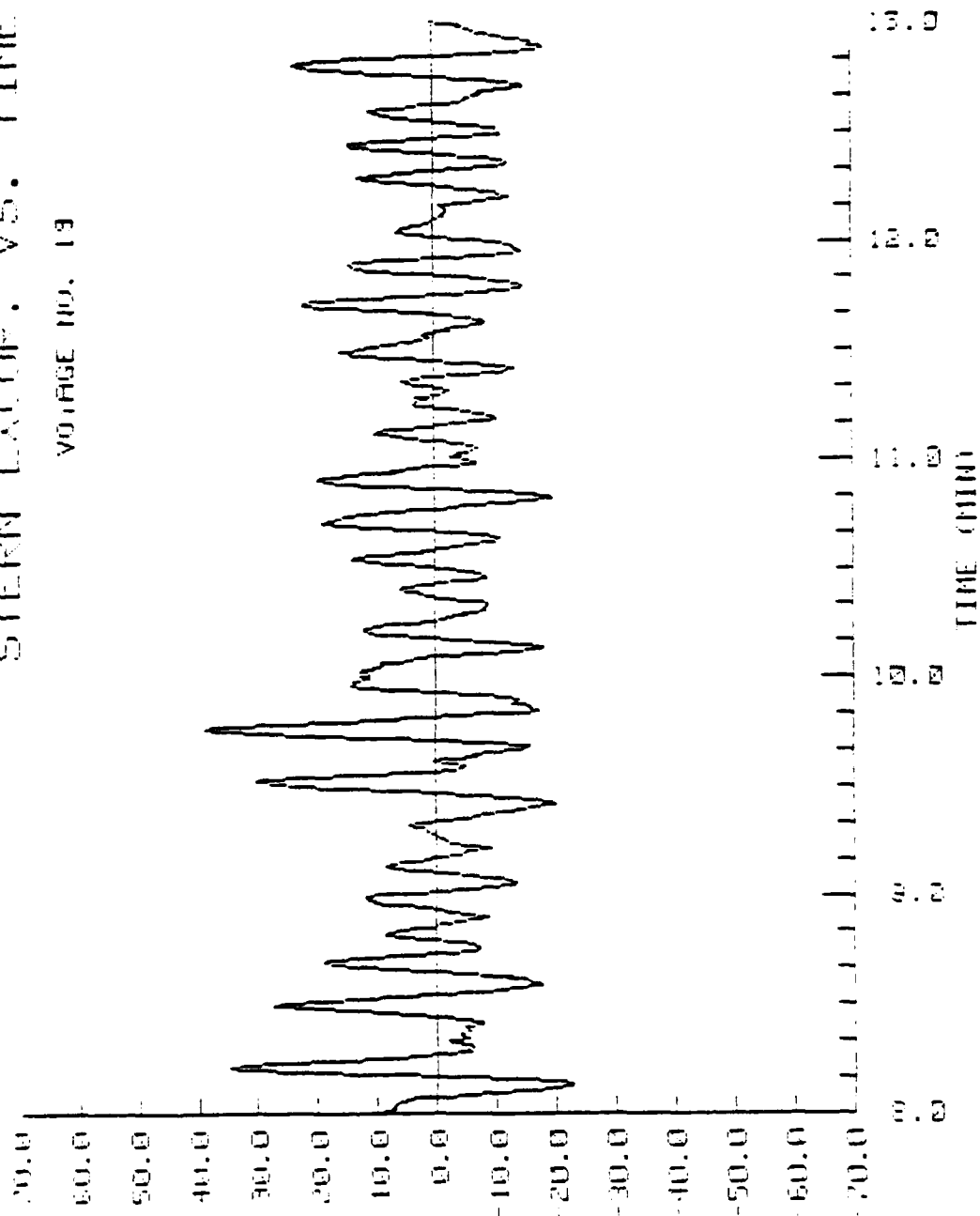
VOLUME NO. 13





# STERN EXCIP. VS. TIME

VOLUME NO. 13

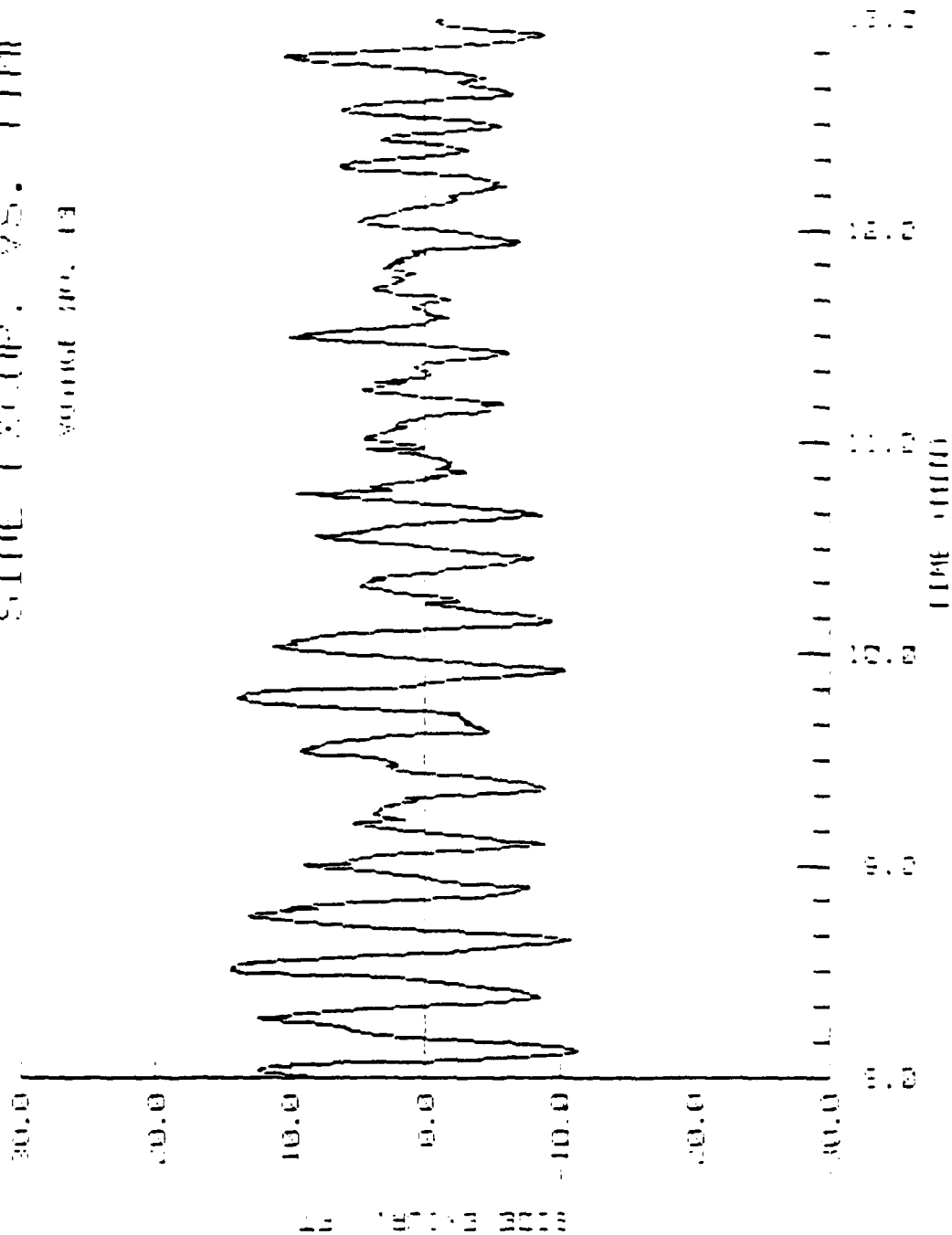


STERN EXCIP. VS. TIME



SIGNAL GROUP, VS. TIME

GROUP NO. 13





# STATISTICAL SUMMARY

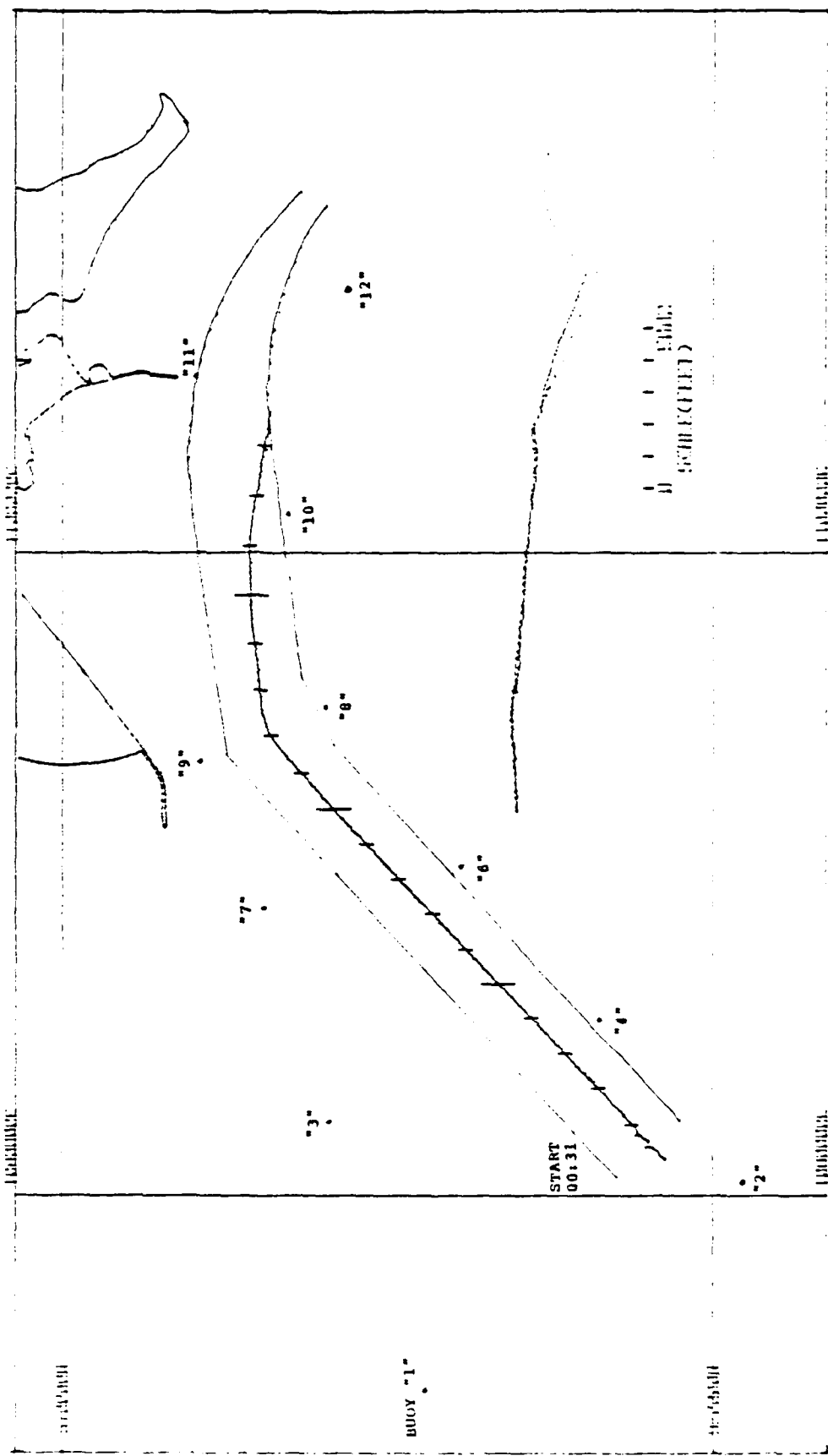
VOYAGE NO. 20

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-0.3	1.2	.4	.5
ROLL (DEG)	-0.1	5.7	2.7	3.0
NO. (FT/SEC/SEC)	-0.0	1.3	.4	.5
HEAVE (FT)	.1	2.5	.8	1.0
ROLL EXCUR. (FT)	.1	8.0	2.5	3.1
STERN EXCUR. (FT)	.1	5.7	1.5	1.8
SIDE EXCUR (FT)	.1	5.3	2.6	3.1



# STATION 101. 200 SHIP TRACK

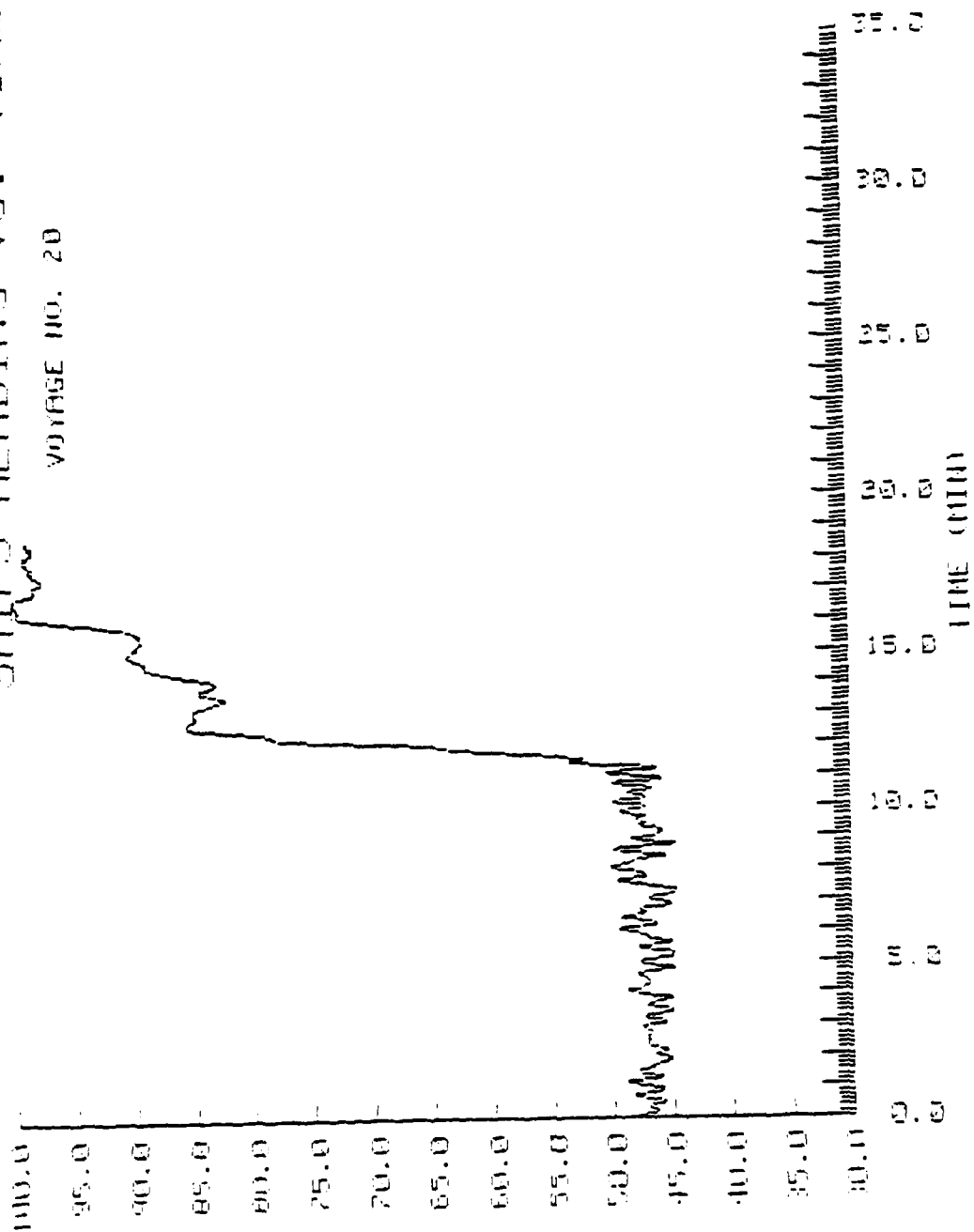
5-10-50





# SHIPS HEADING VS. TIME

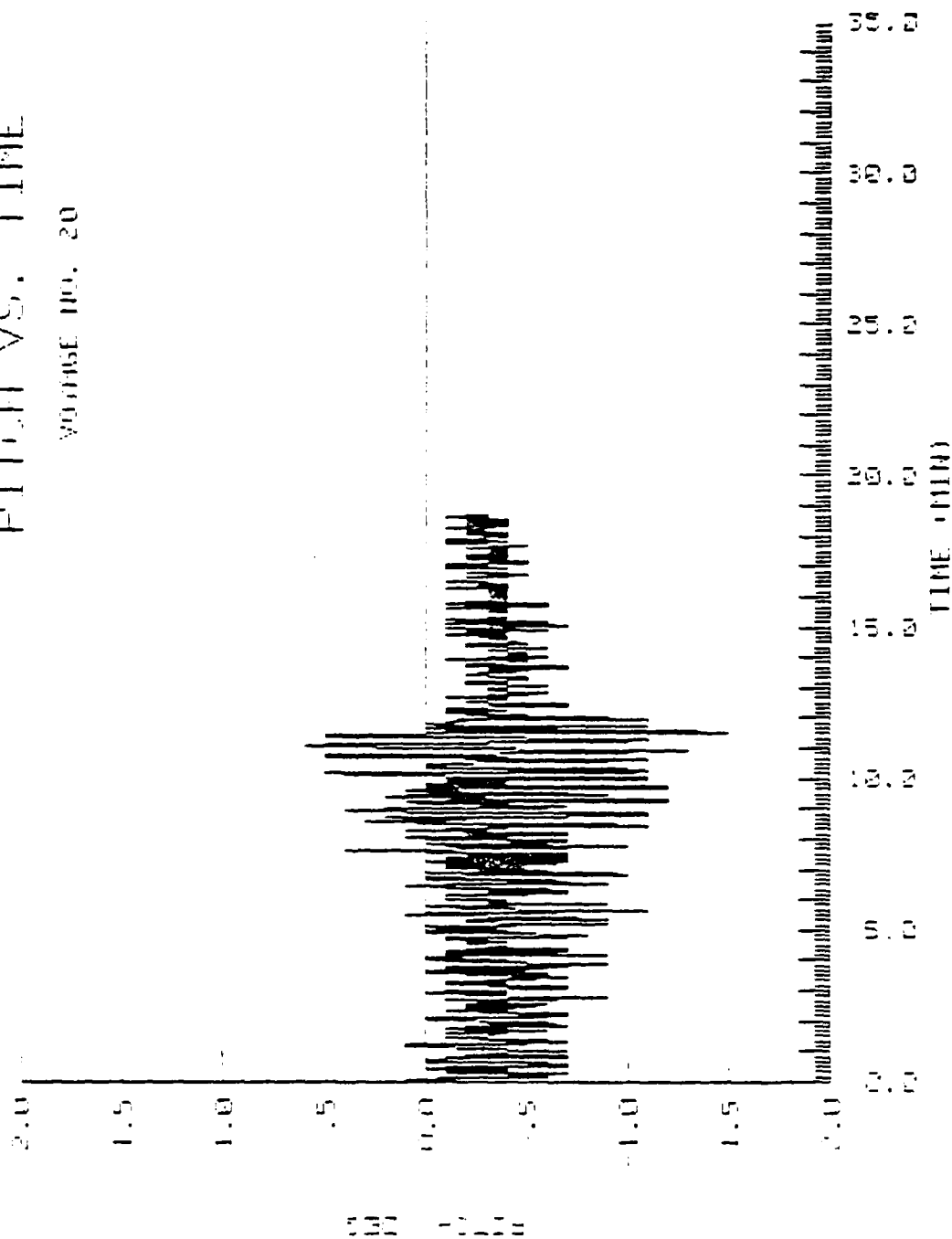
VOYAGE NO. 20





# PITCH VS. TIME

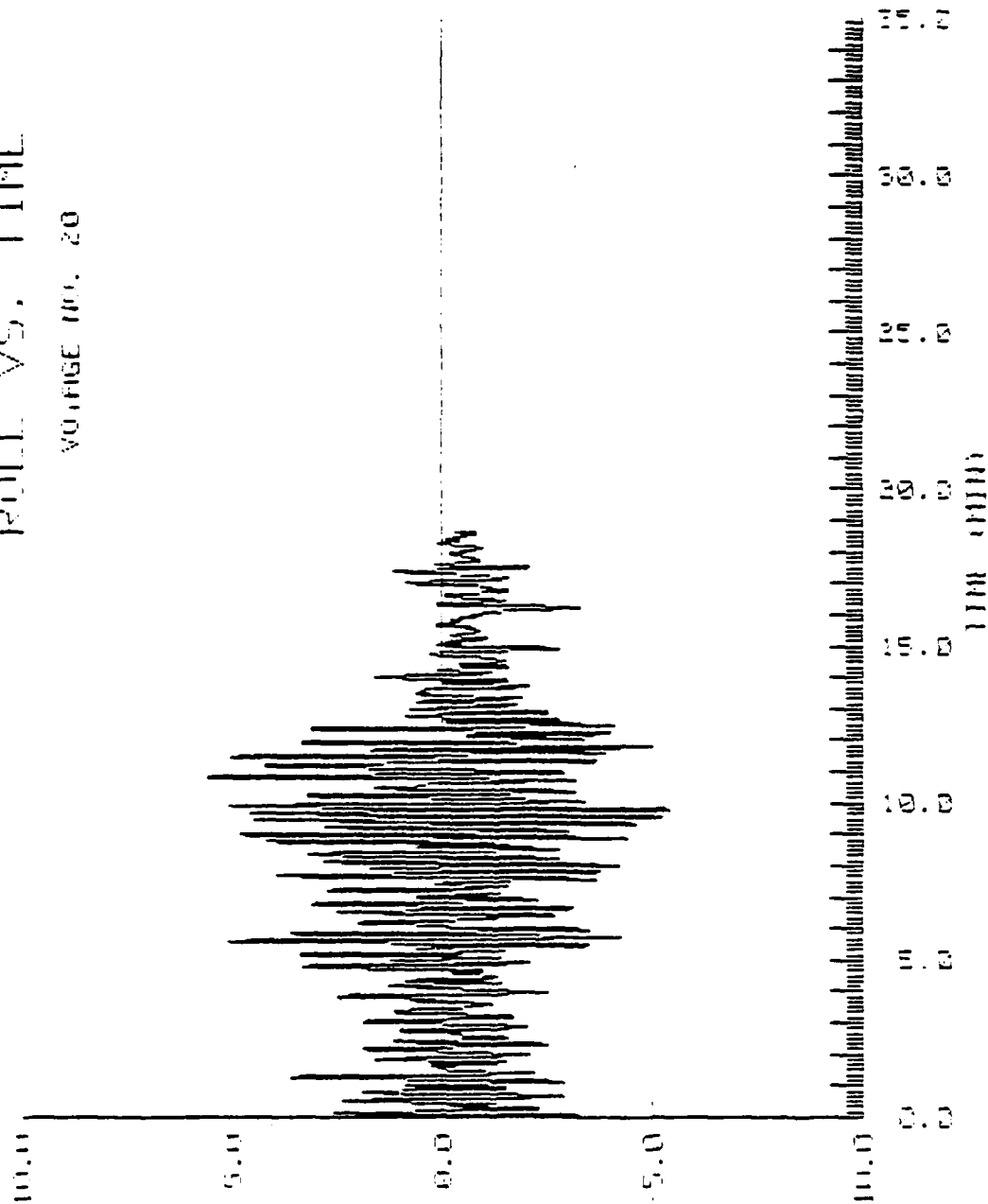
VOLUME 100, 20





# ROLL VS. TIME

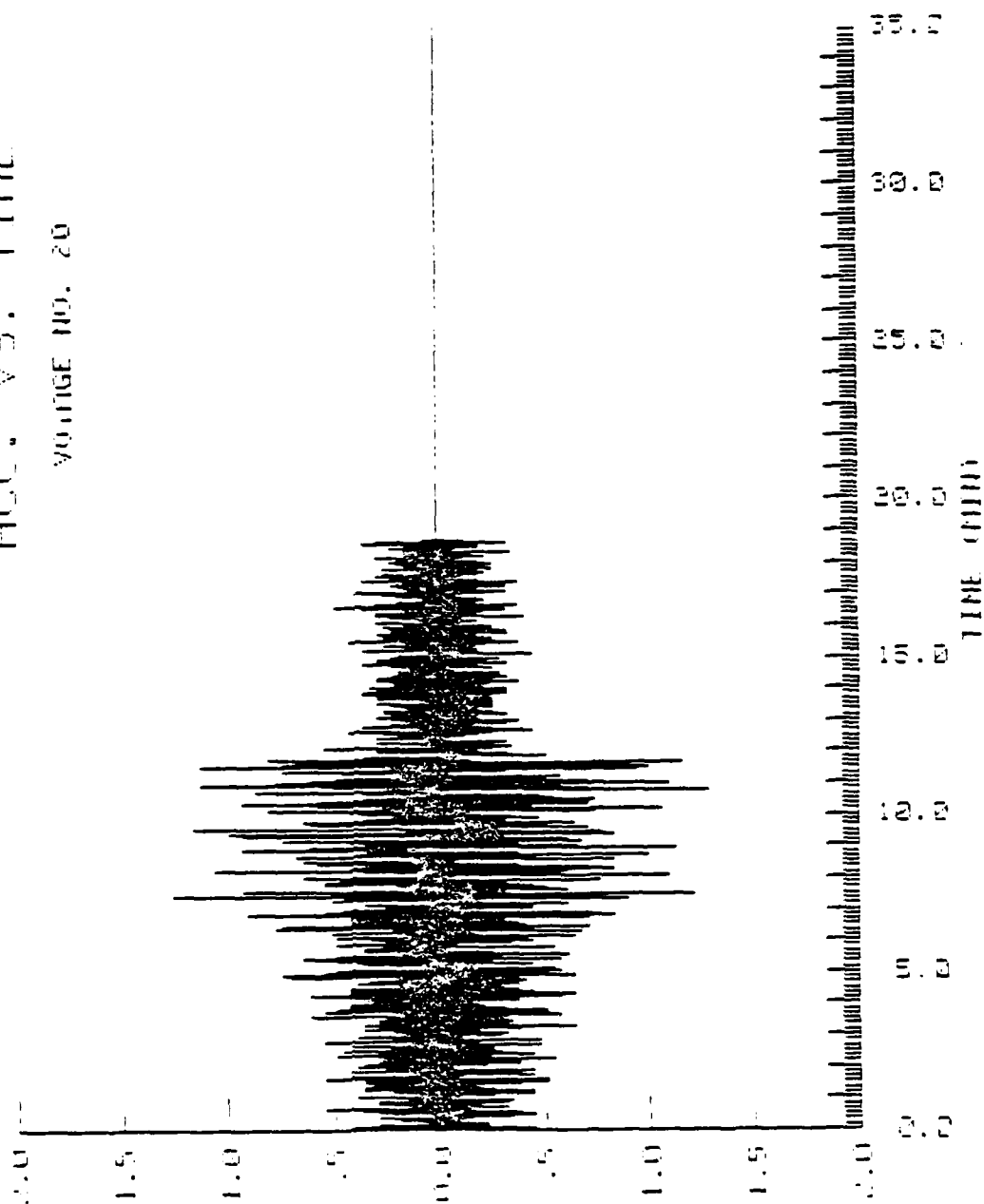
VOLTS 100. 20





REC. VS. TIME

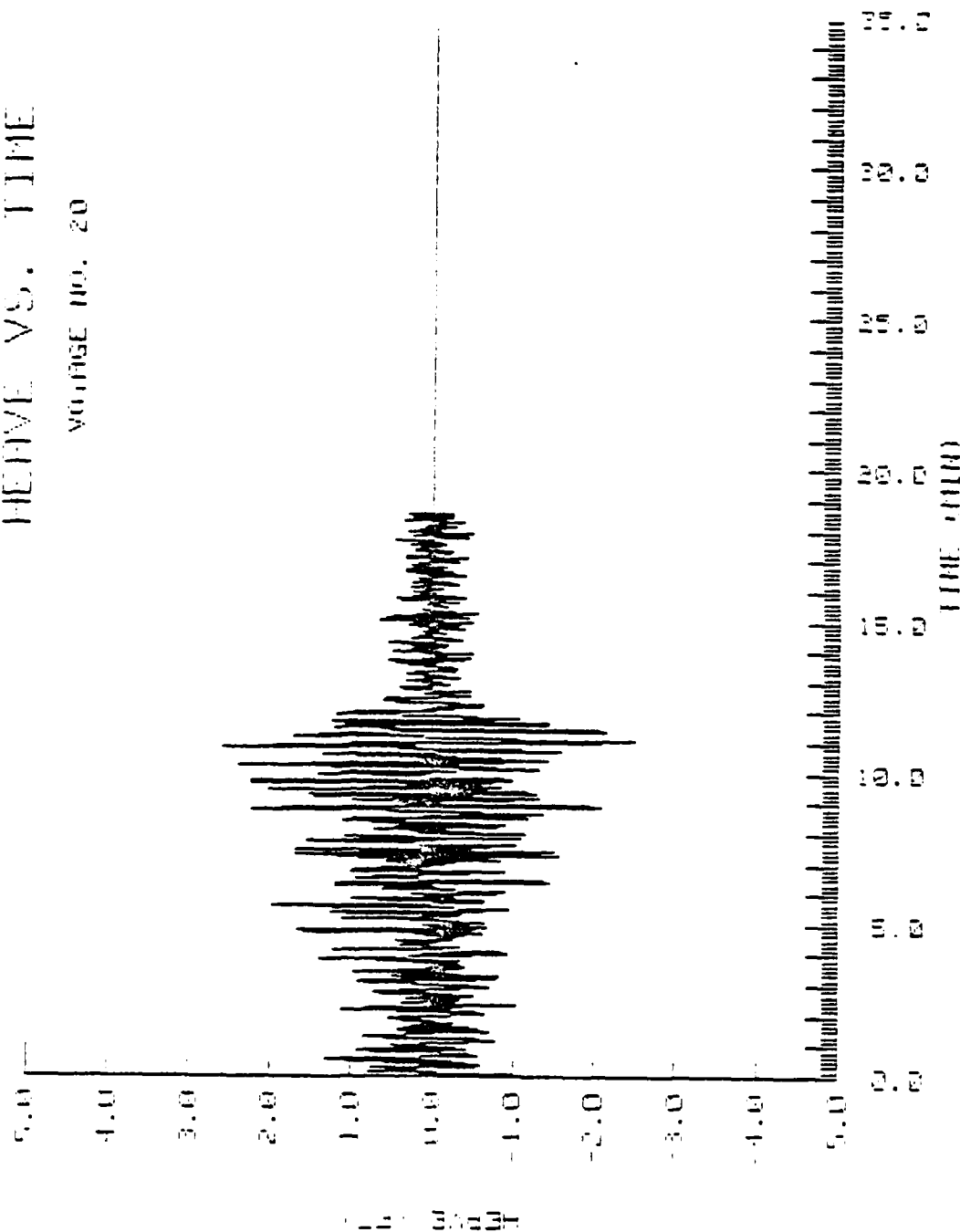
VOLUME NO. 20





# HEAVE VS. TIME

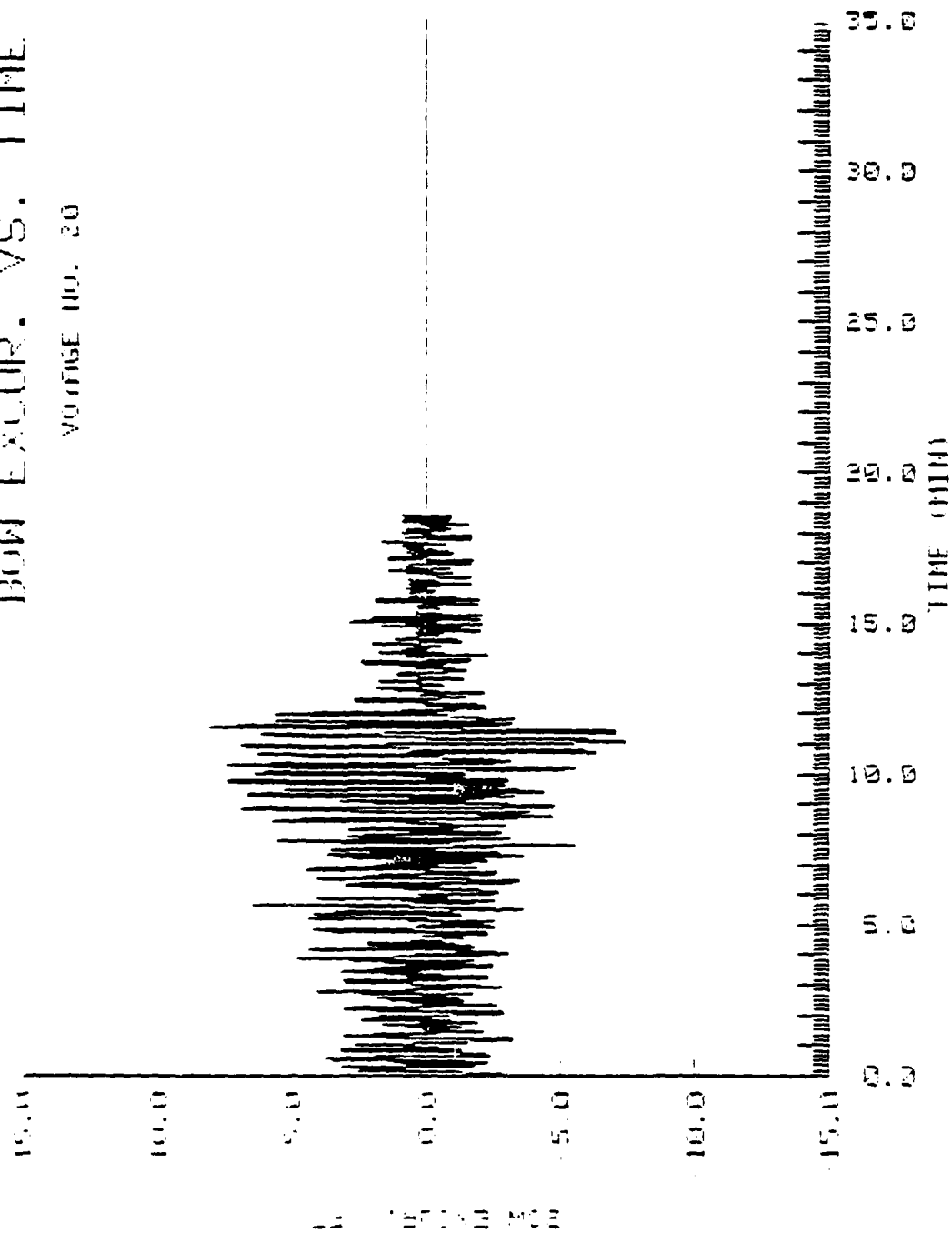
VOLUME NO. 20





# BOW EXCUR. VS. TIME

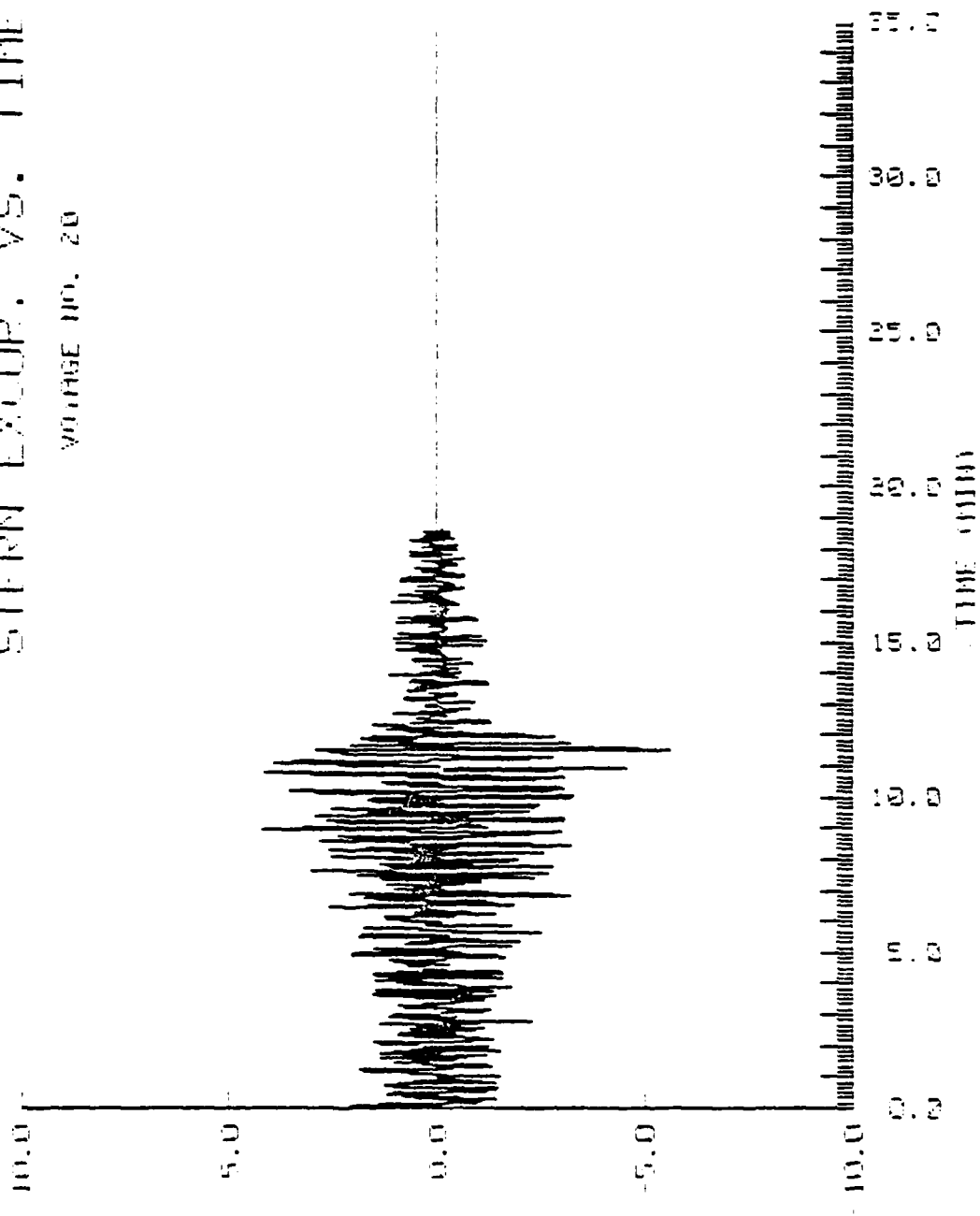
VOLUME NO. 20





# STERN EXCUR. VS. TIME

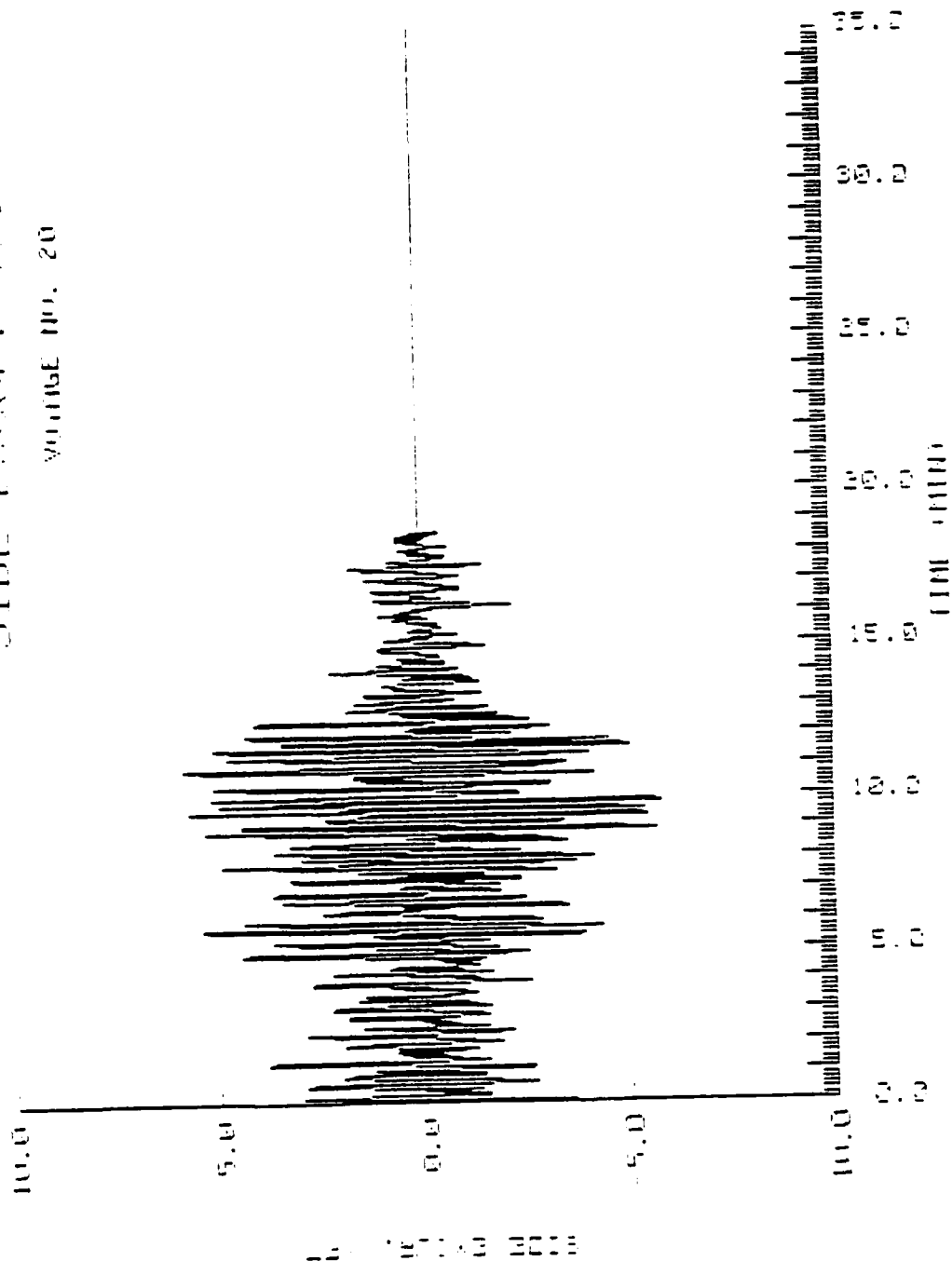
VOLUME NO. 20





SLIDE GROUP, VS. TIME

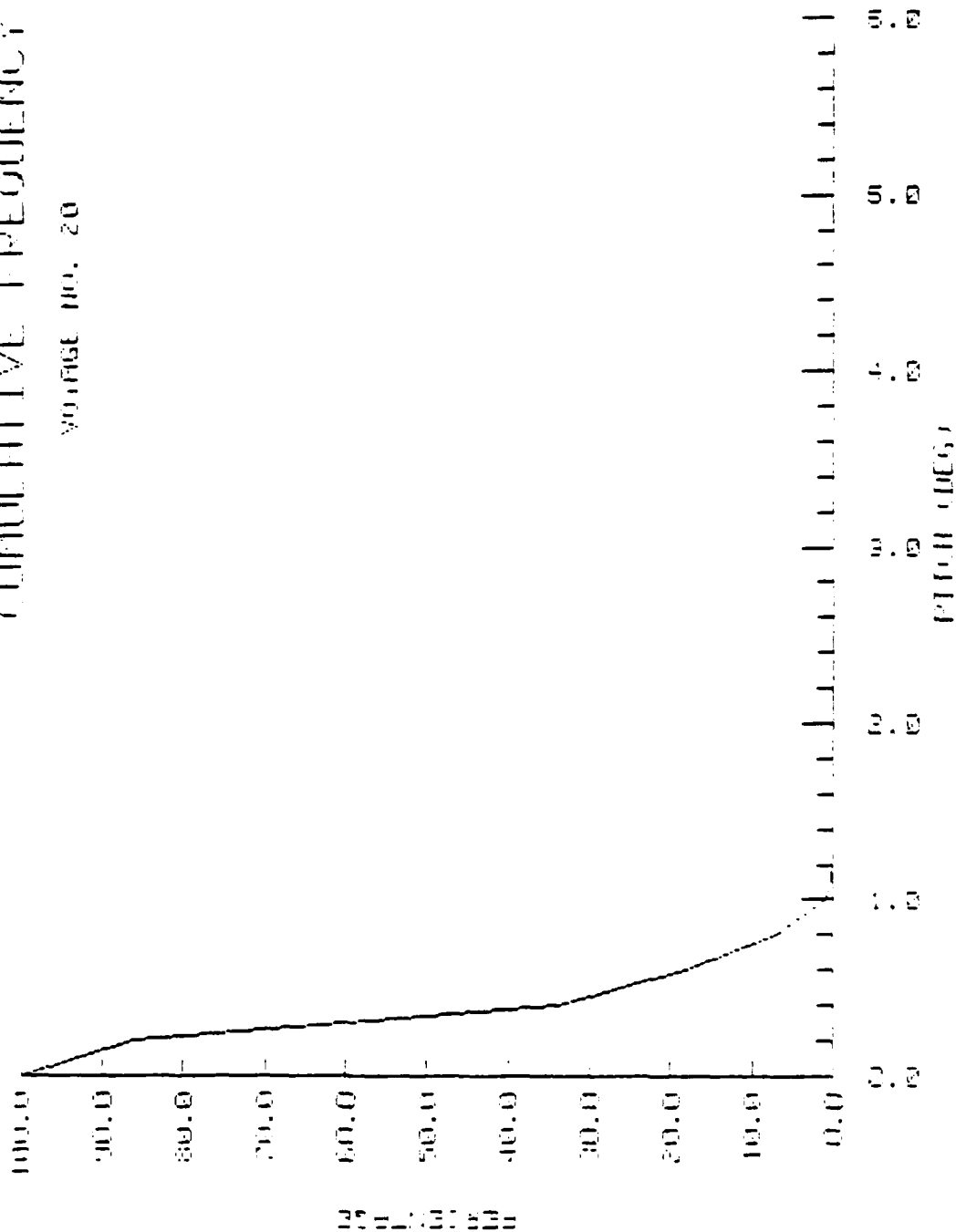
YOUNG NO. 20





# CUMULATIVE FREQUENCY

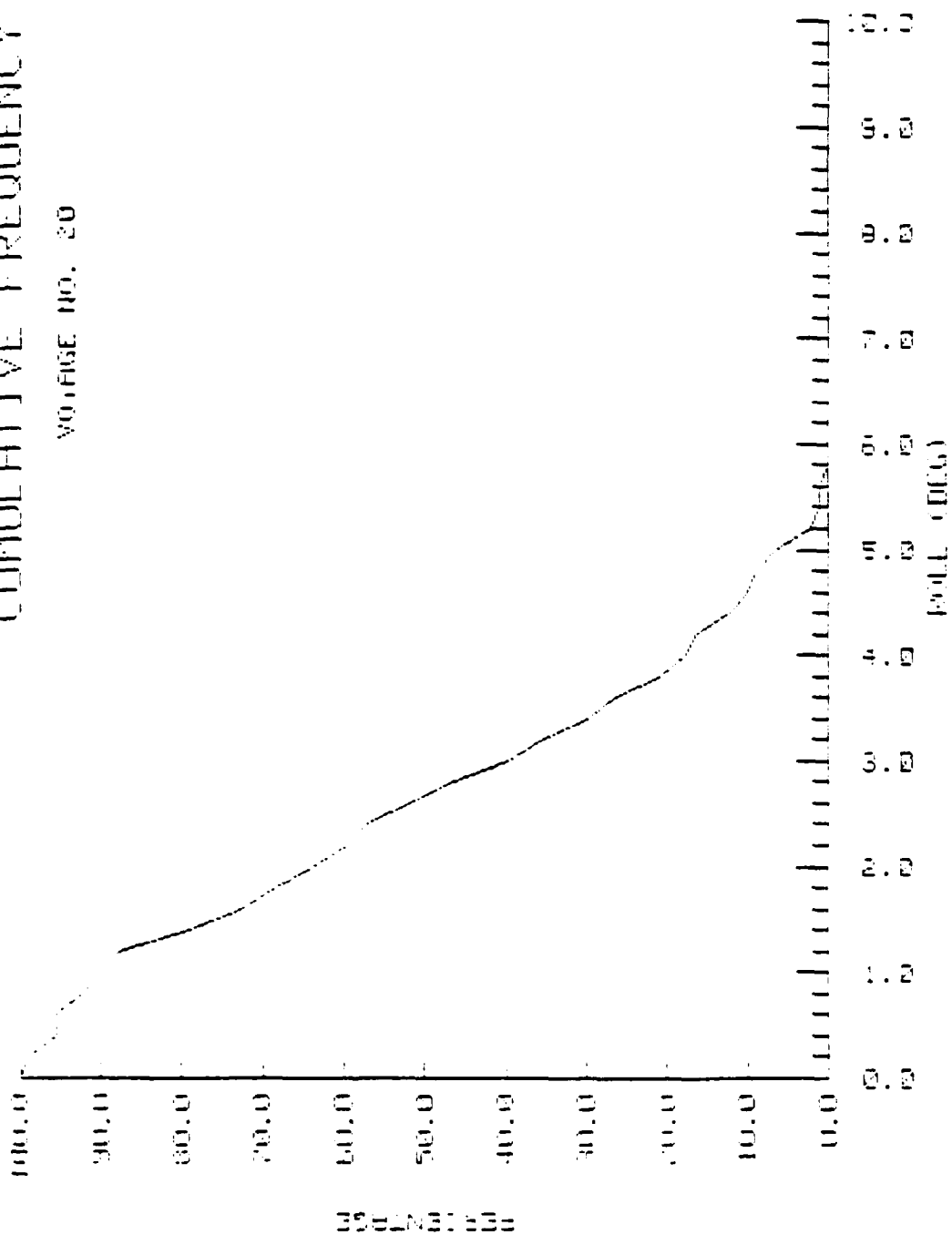
VOLUME NO. 20





# CUMULATIVE FREQUENCY

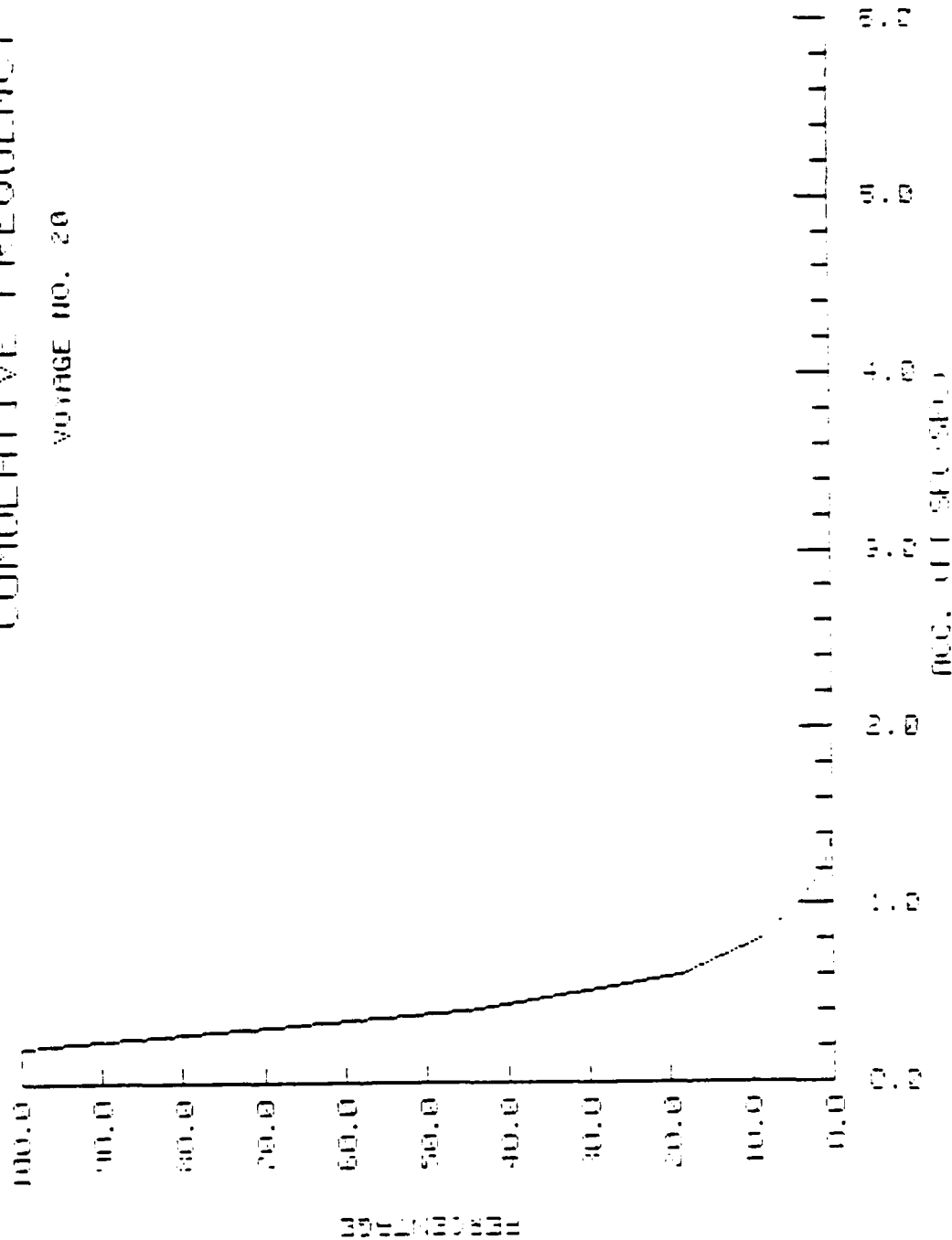
VOLAGE NO. 20





# CUMULATIVE FREQUENCY

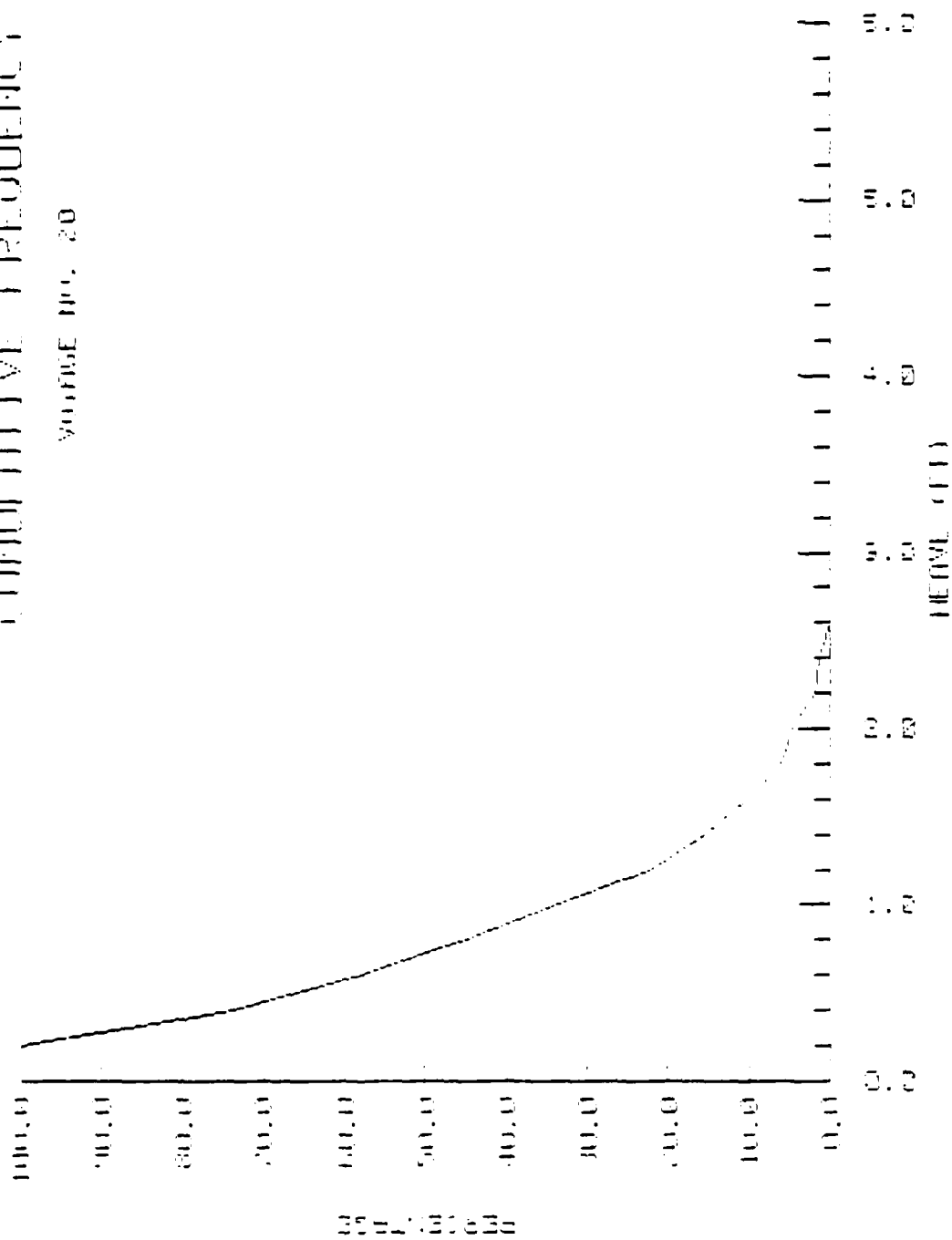
VOLUME NO. 20





# CUMULATIVE FREQUENCY

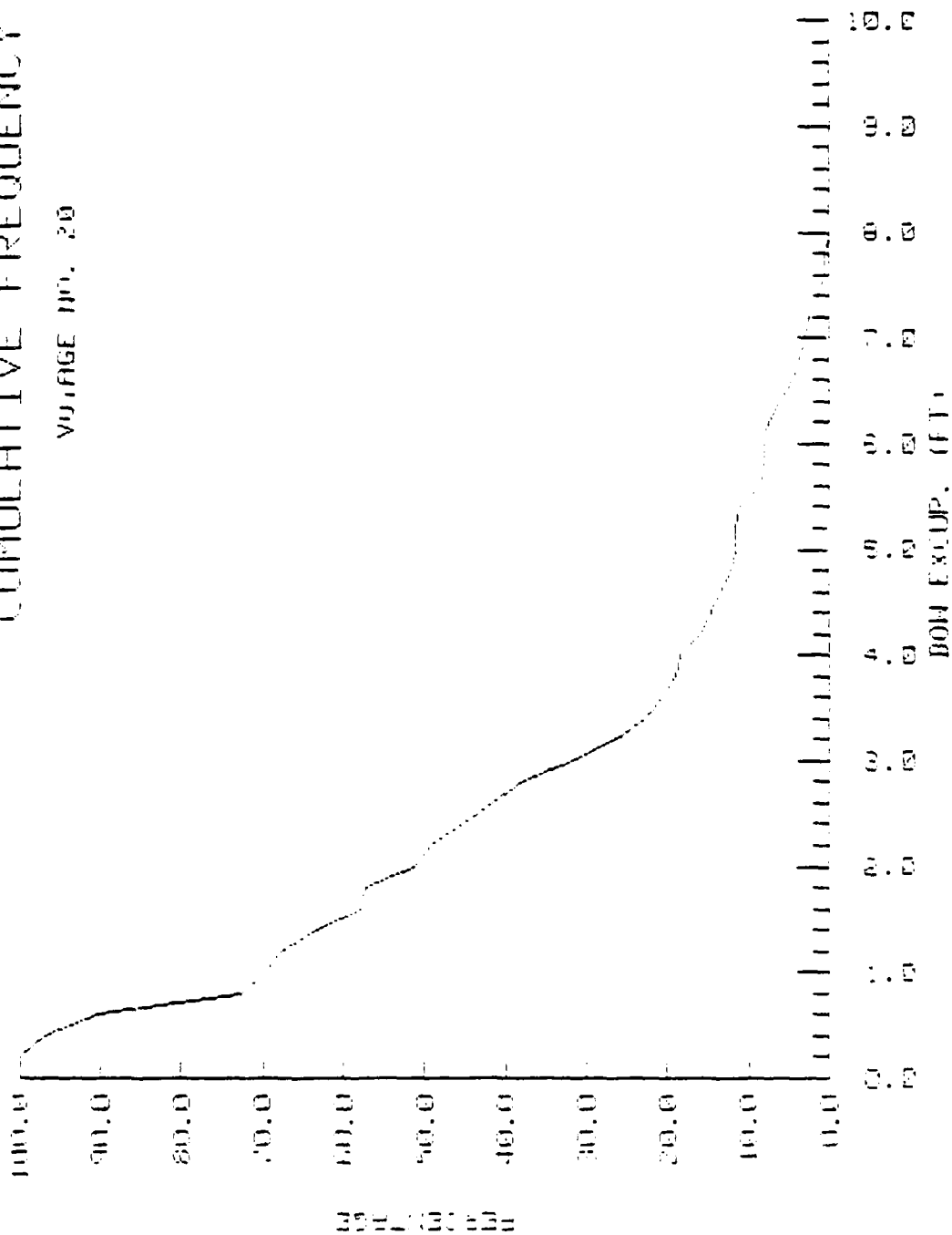
YOUNG NO. 20





# CUMULATIVE FREQUENCY

VOLUME NO. 20

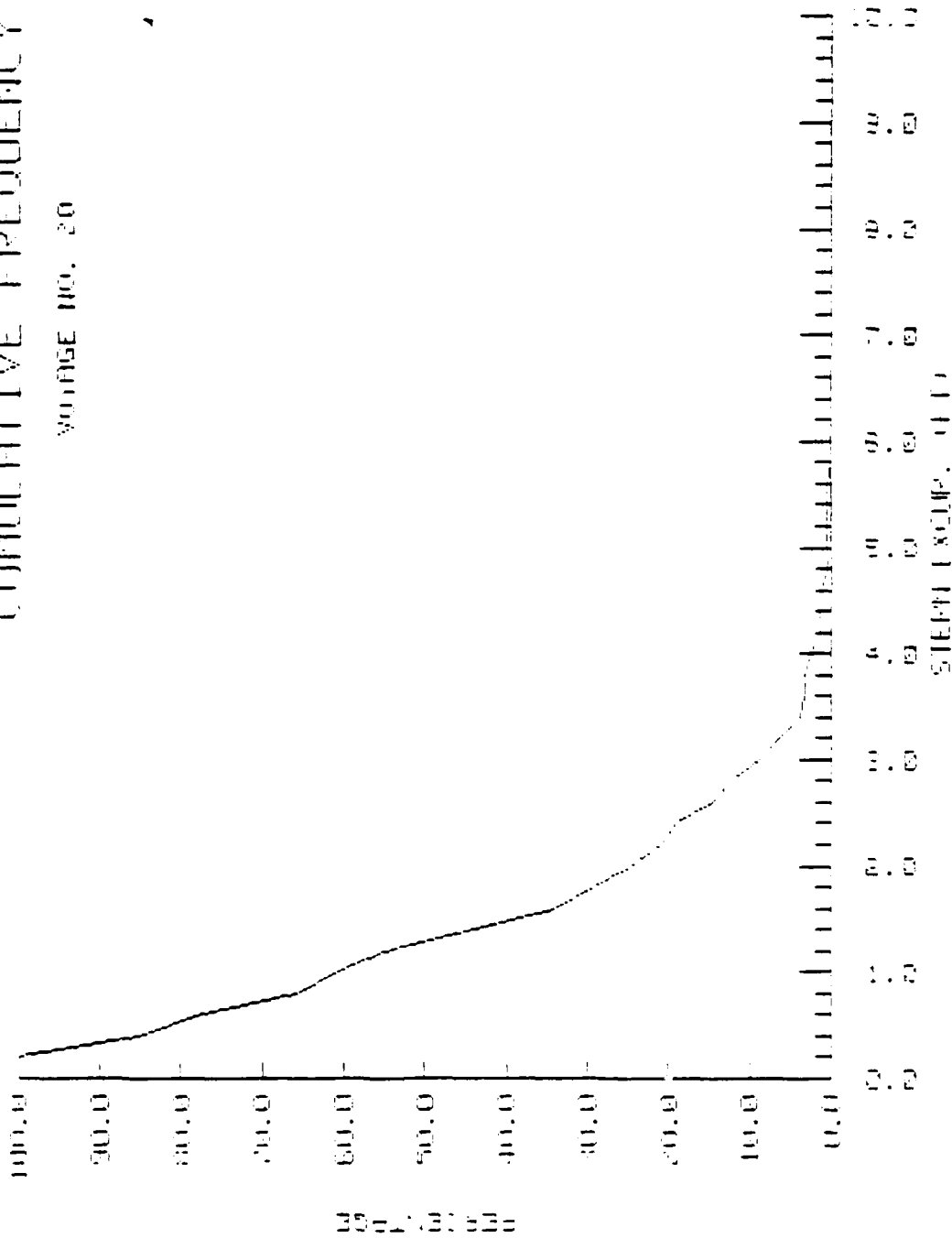


BOW EXCURSION (FT)



# CUMULATIVE FREQUENCY

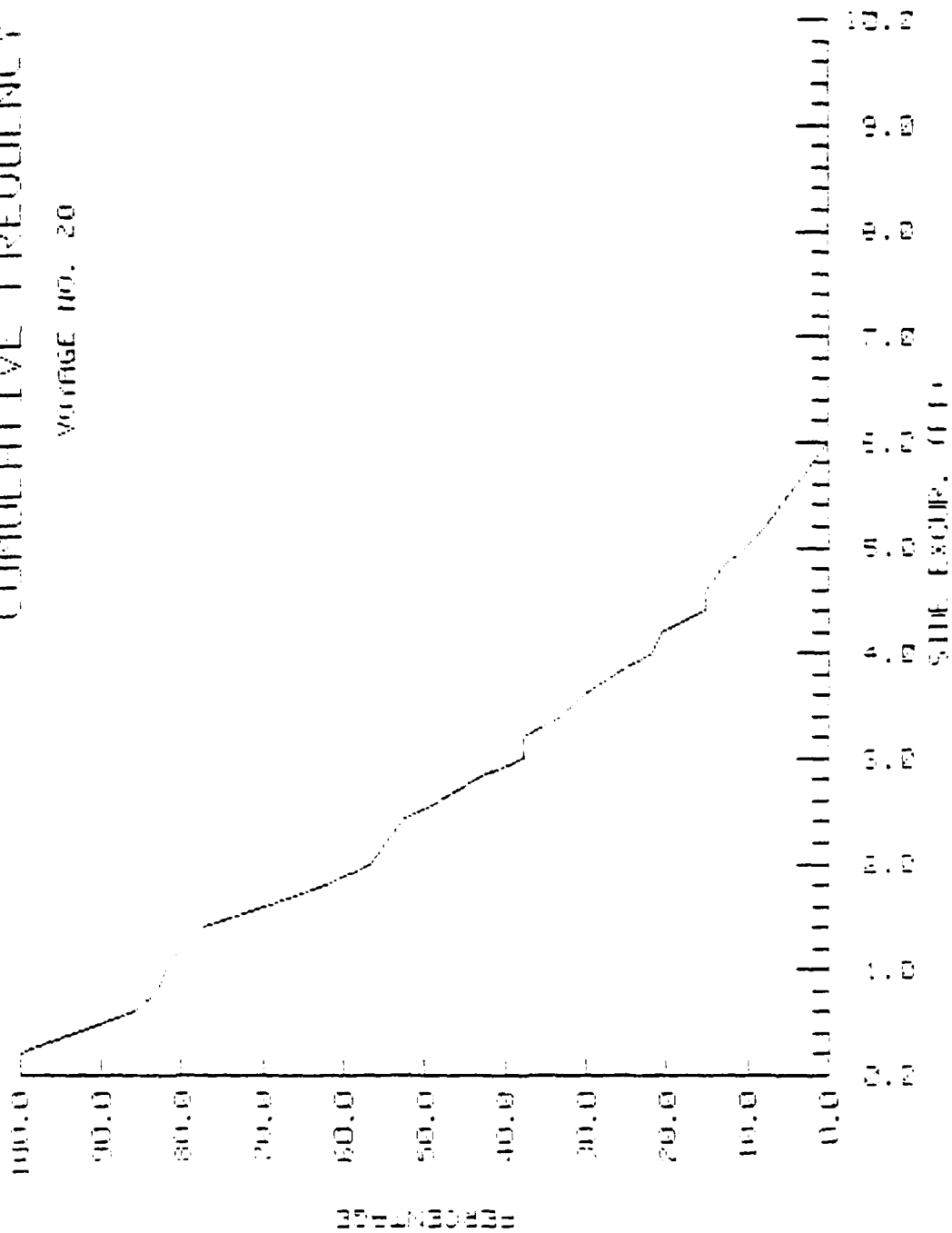
VOLUME NO. 20





# CUMULATIVE FREQUENCY

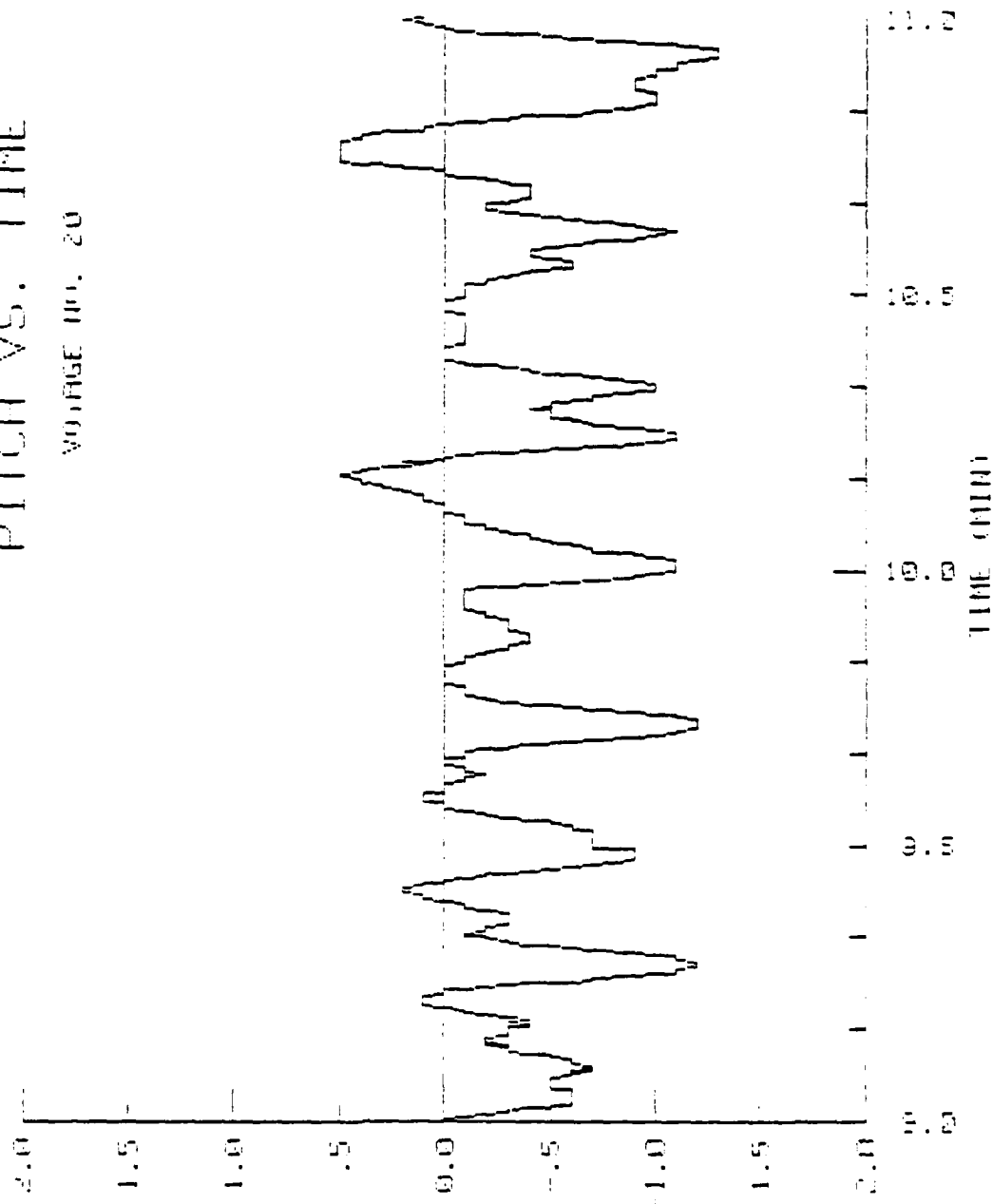
VORAGE NO. 20





# PITCH VS. TIME

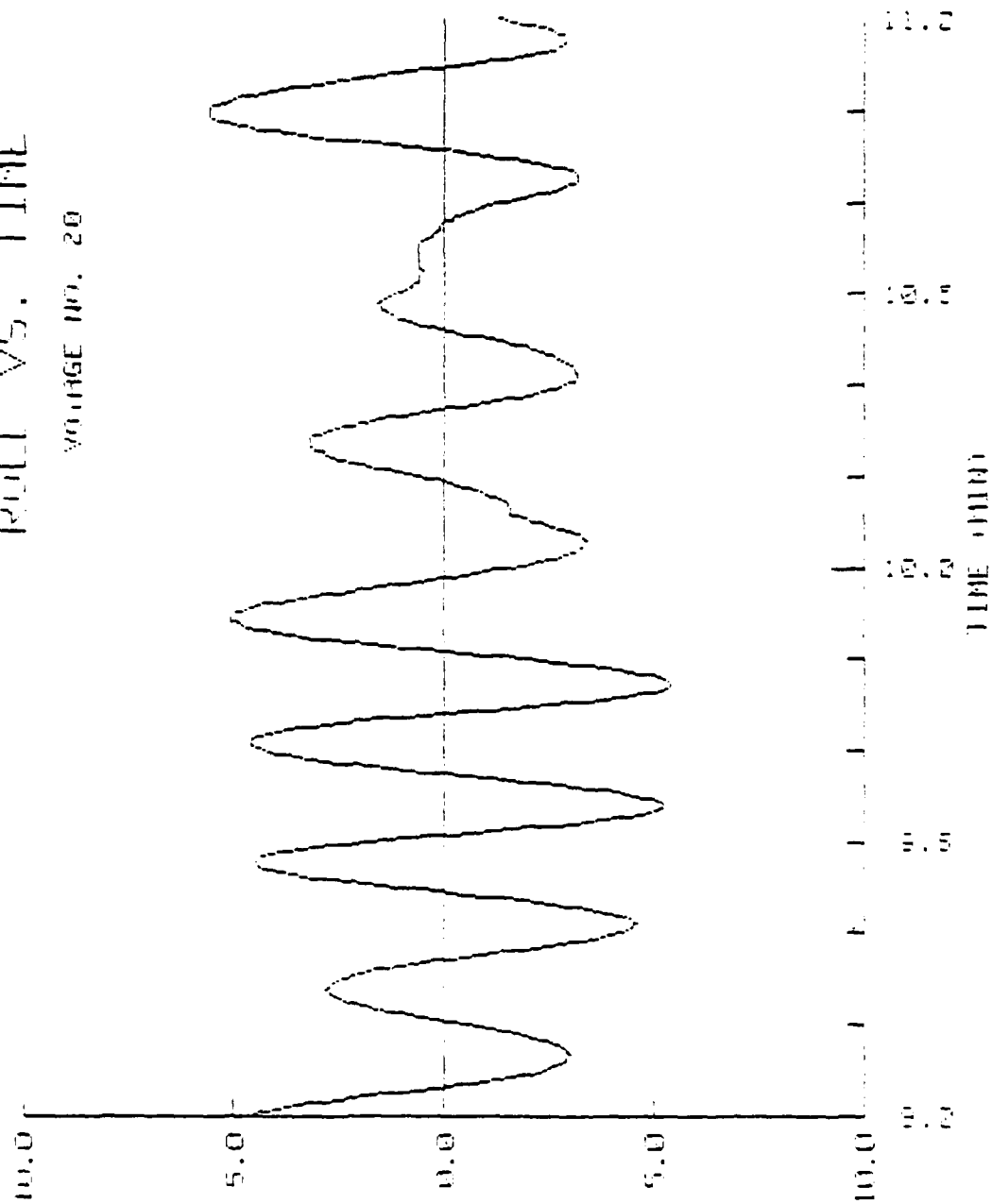
VOLUME 100, 20





ROLL VS. TIME

VOLAGE NO. 20

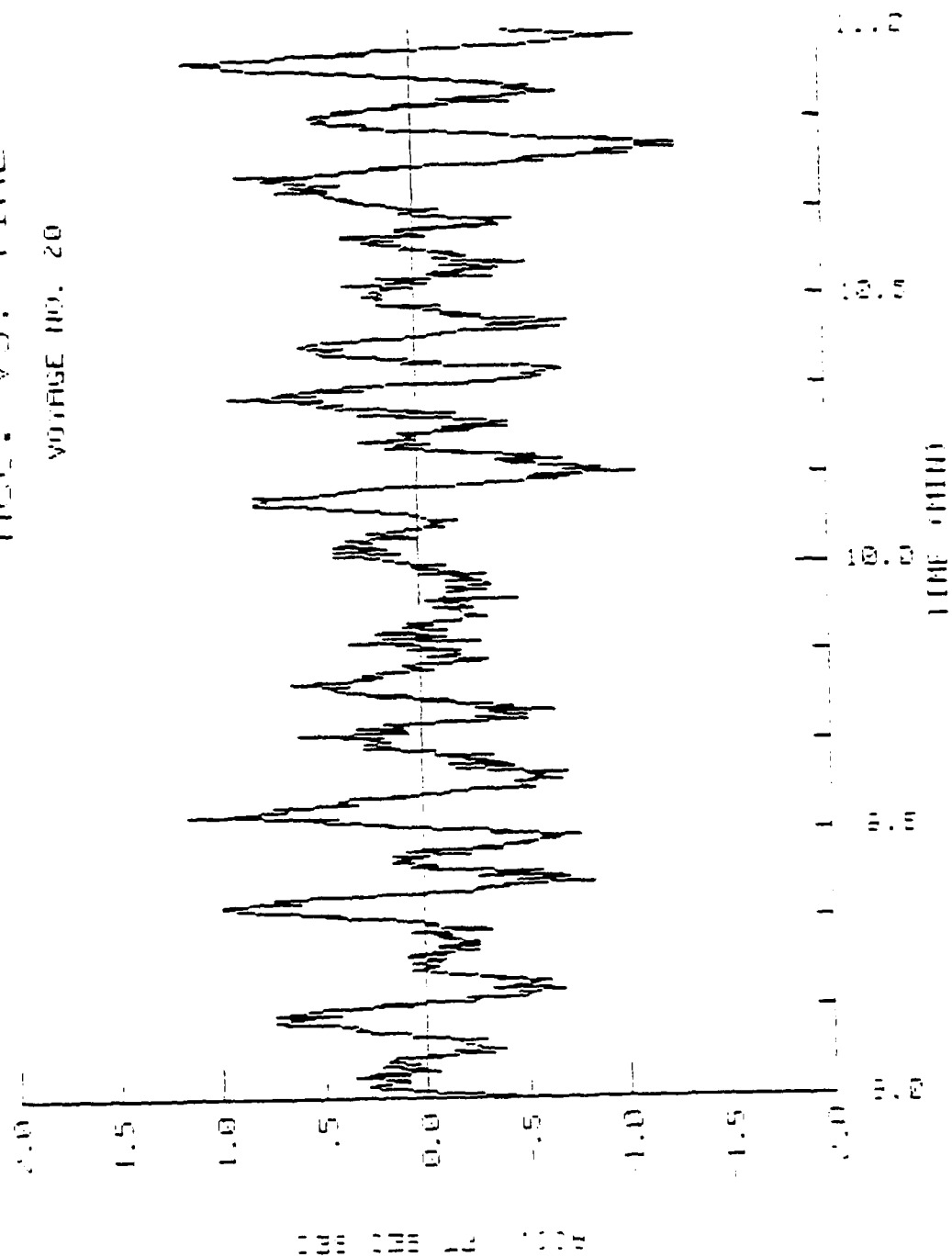


131 17.08



POL. VS. TIME

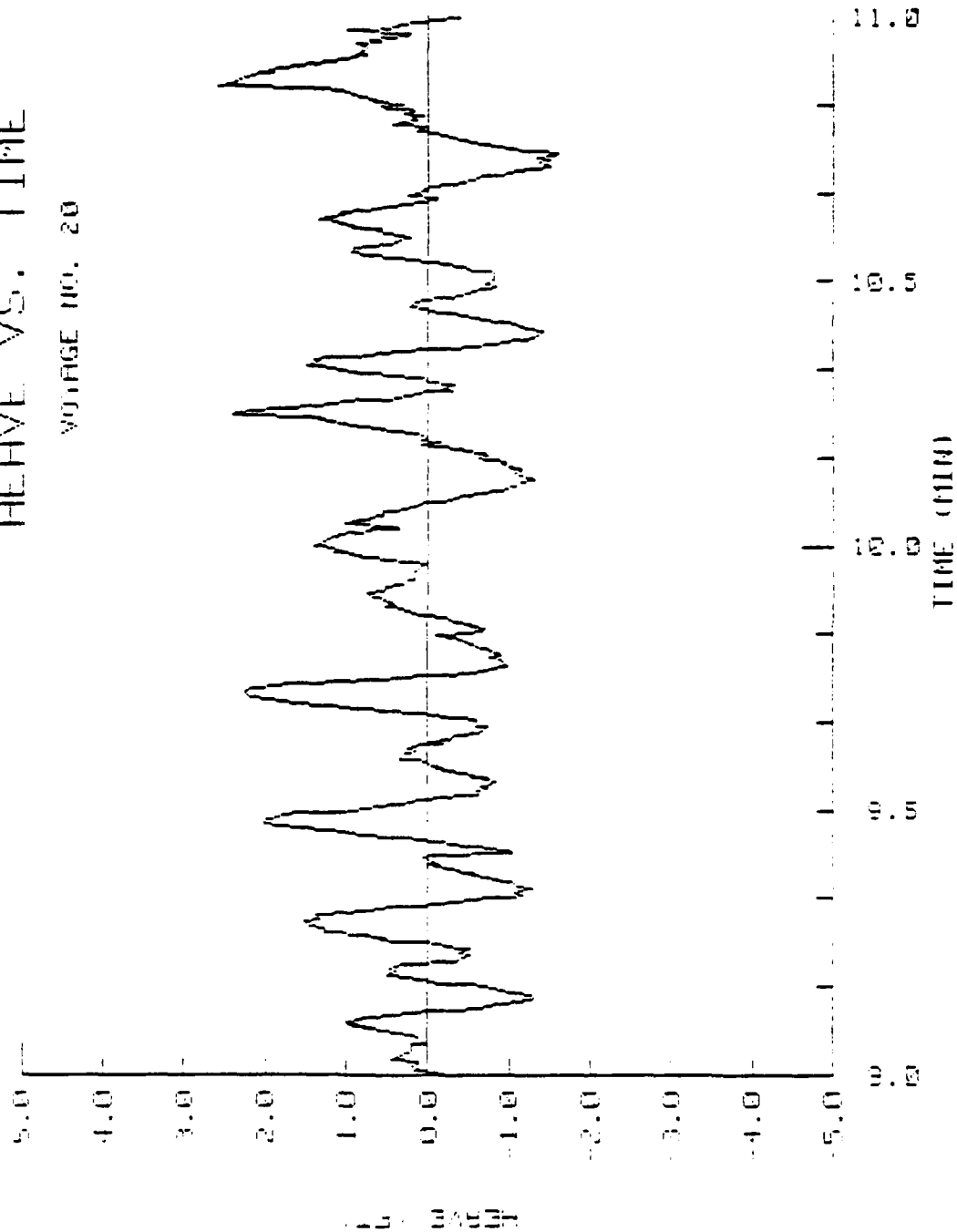
VOLTAGE NO. 20





# HEAVE VS. TIME

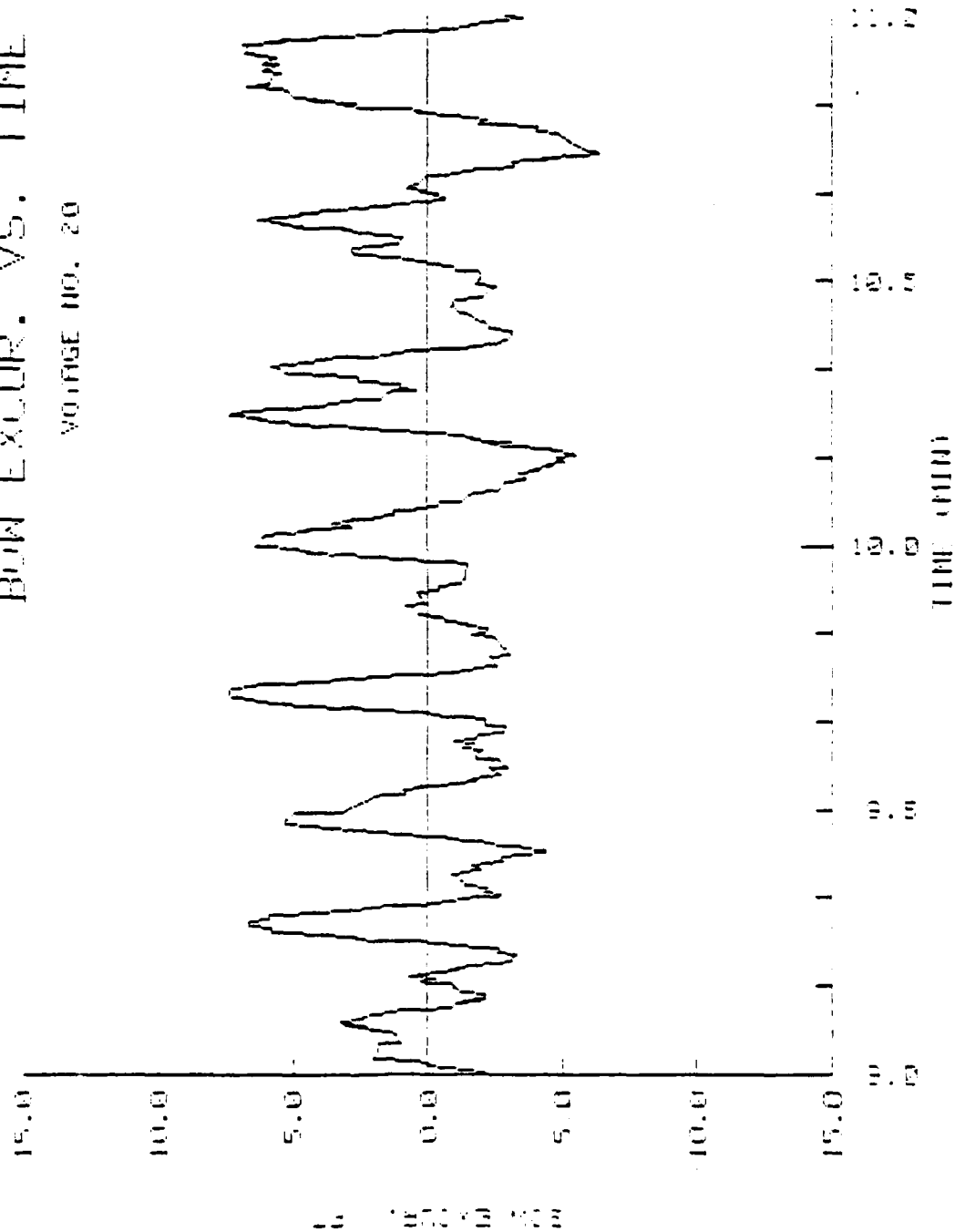
VOLUME NO. 20





# BOW EXCUR. VS. TIME

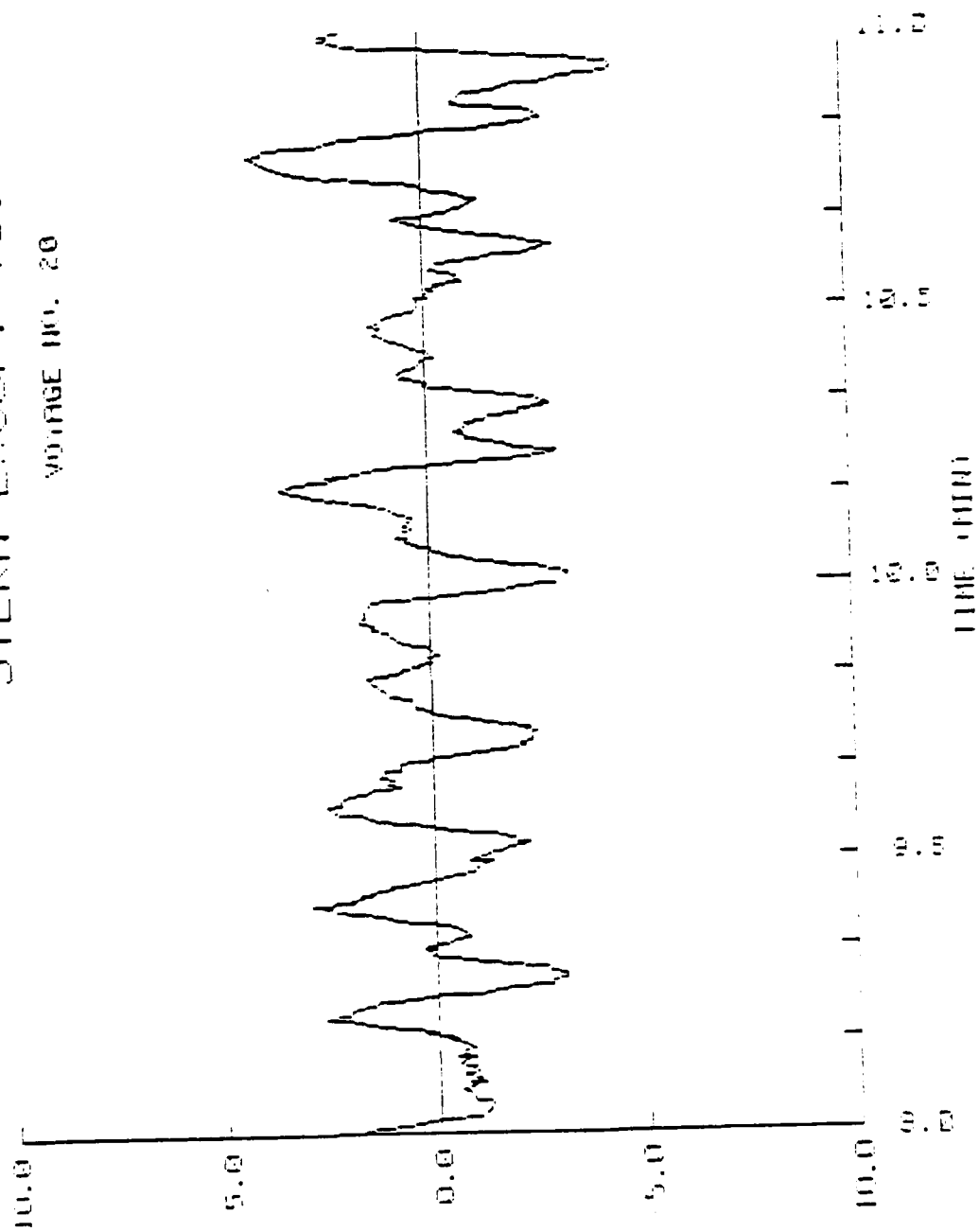
VOLUME NO. 20





# STERN EXCUR. VS. TIME

VOLTAGE NO. 20

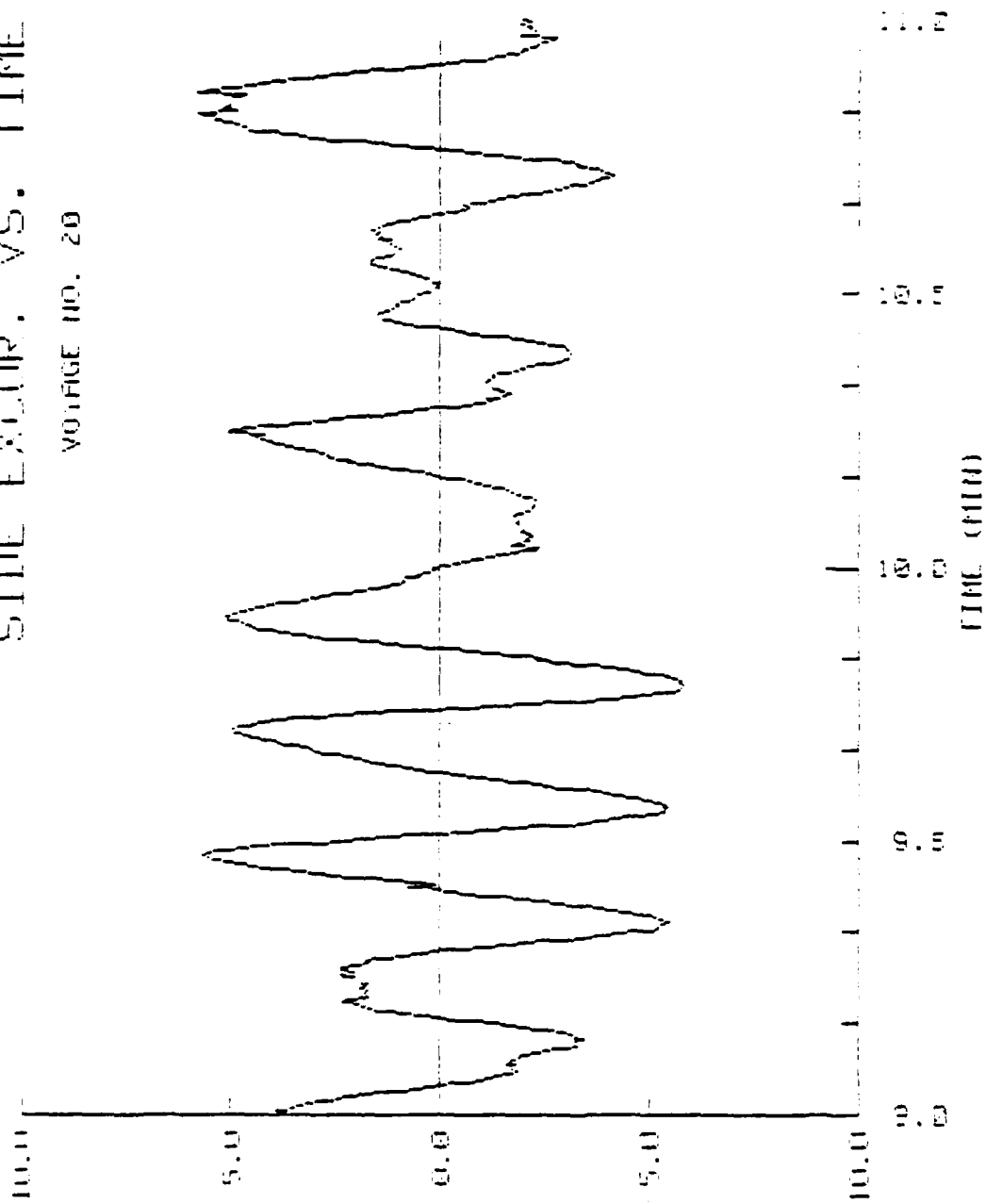


STERN EXCUR.



# SIDE EXCUR. VS. TIME

VOLUME NO. 20





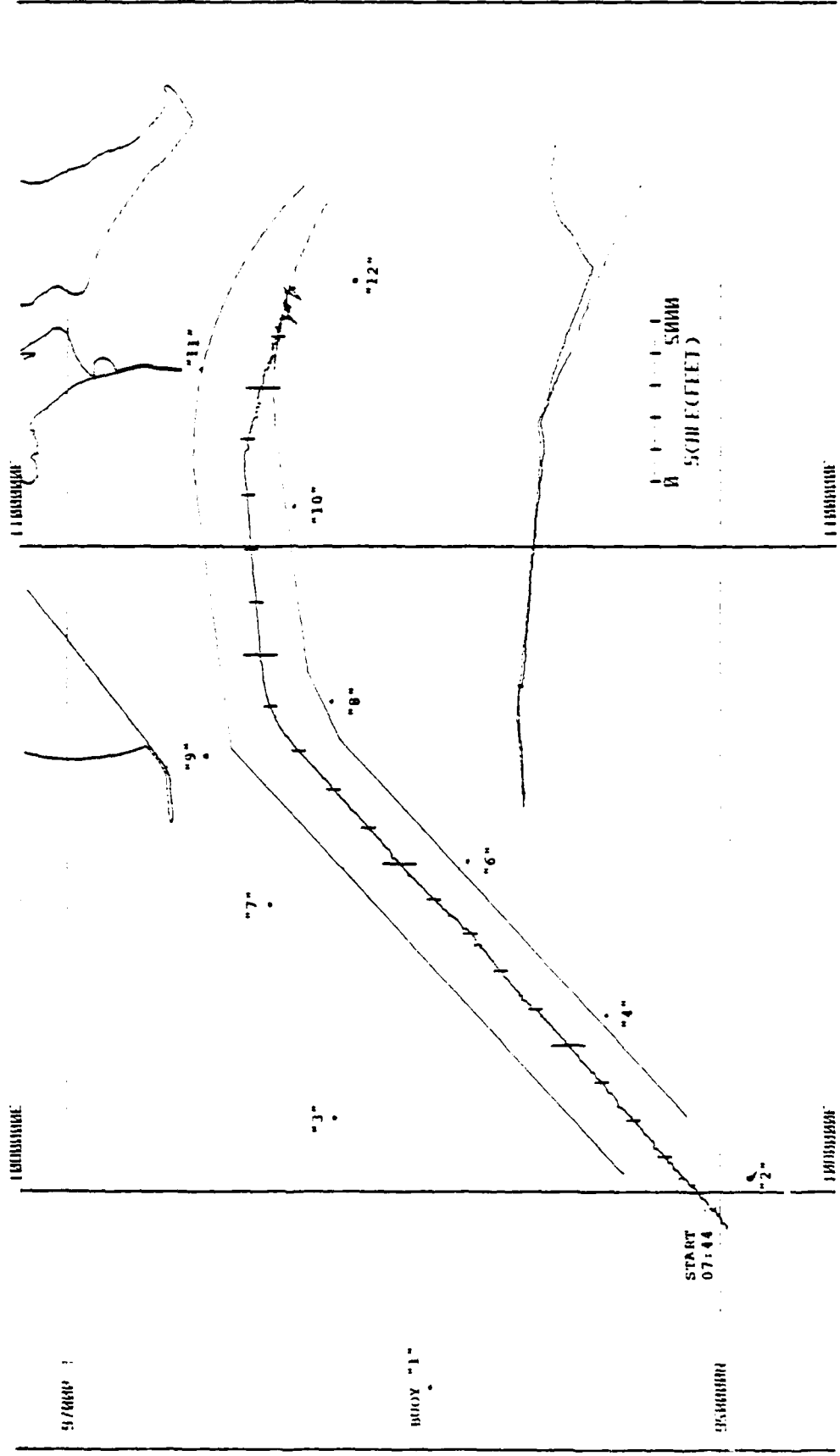
# STATISTICAL SUMMARY

VOTAGE (NO. 2)

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	PMS
PITCH (DEG)	-1.9	1.8	.8	.8
ROLL (DEG)	.7	11.7	5.1	5.7
YAW (FT SEC SEC)	-1.0	3.8	1.0	1.2
HEAVE (FT)	.2	4.0	1.6	1.8
ROLL EXCUR. (FT)	.2	12.3	4.4	5.3
STIFF EXCUR. (FT)	.2	7.4	2.7	3.1
STIFF EXCUR. (FT)	.2	10.4	3.8	4.4



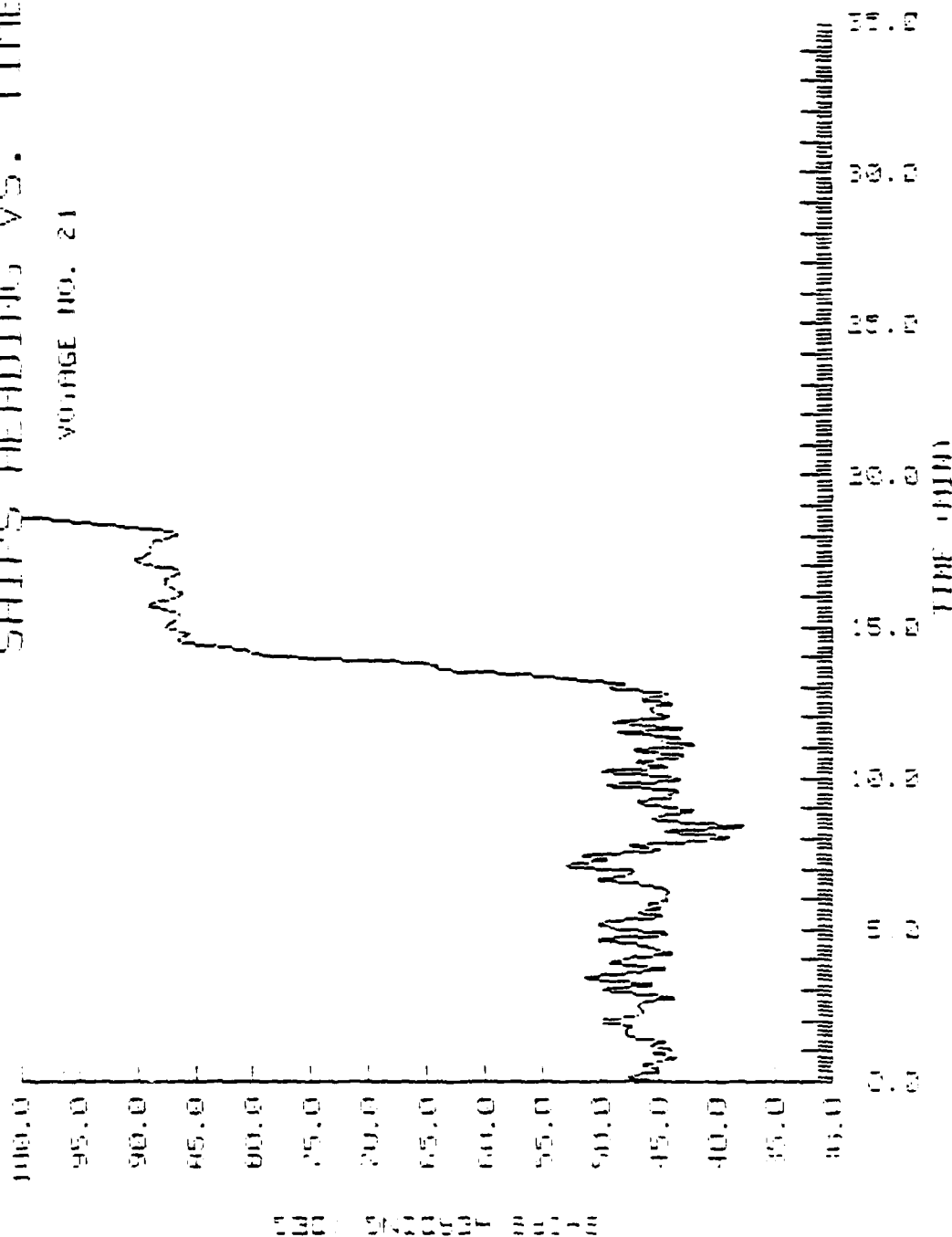
# VIIYUHE NO. 21 GUTT' TRICK SCOUT 13 300000





# SHIPS HEADING VS. TIME

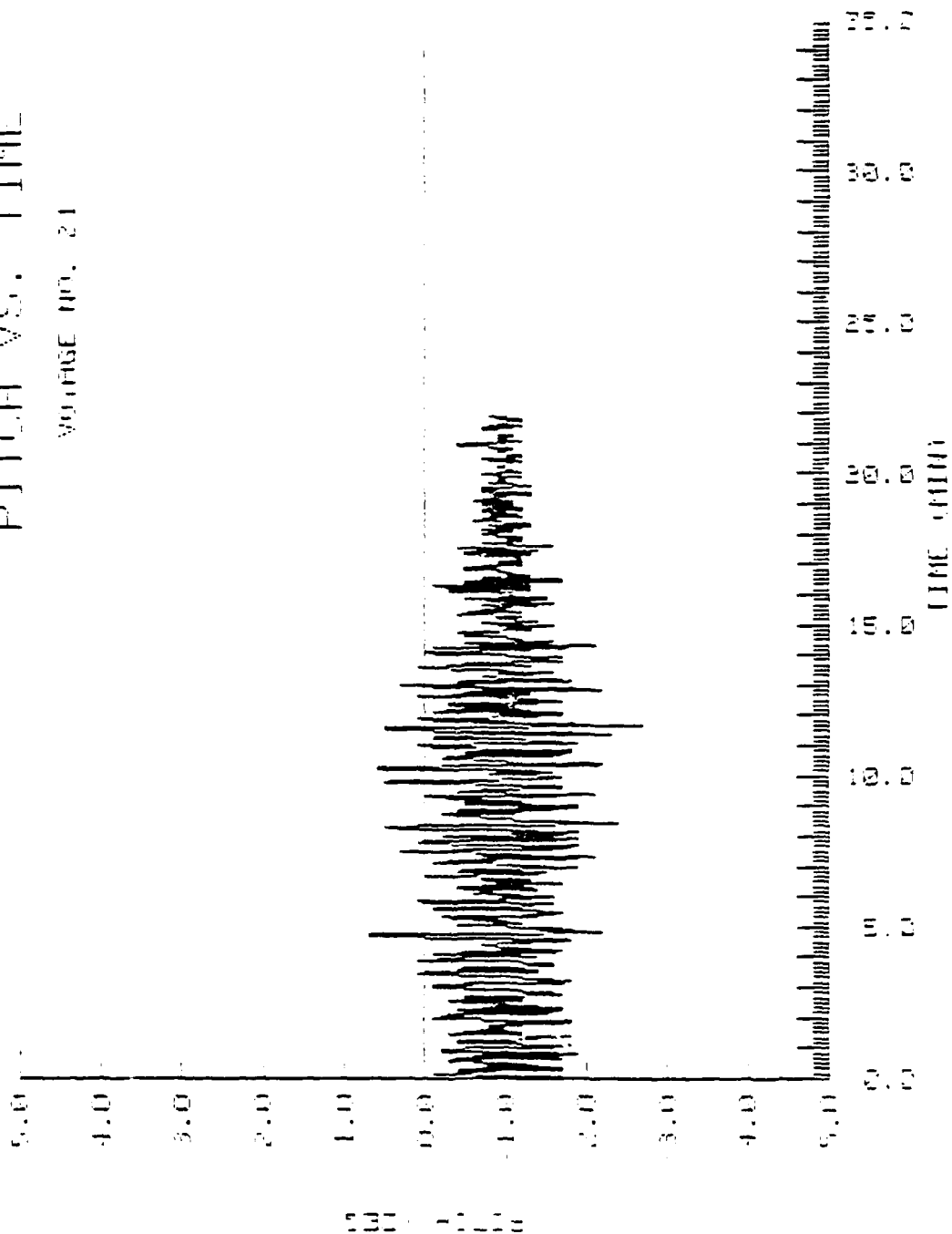
VOYAGE NO. 21





# PITCH VS. TIME

VOLUME NO. 21





# PULL VS. TIME WING NO. 21

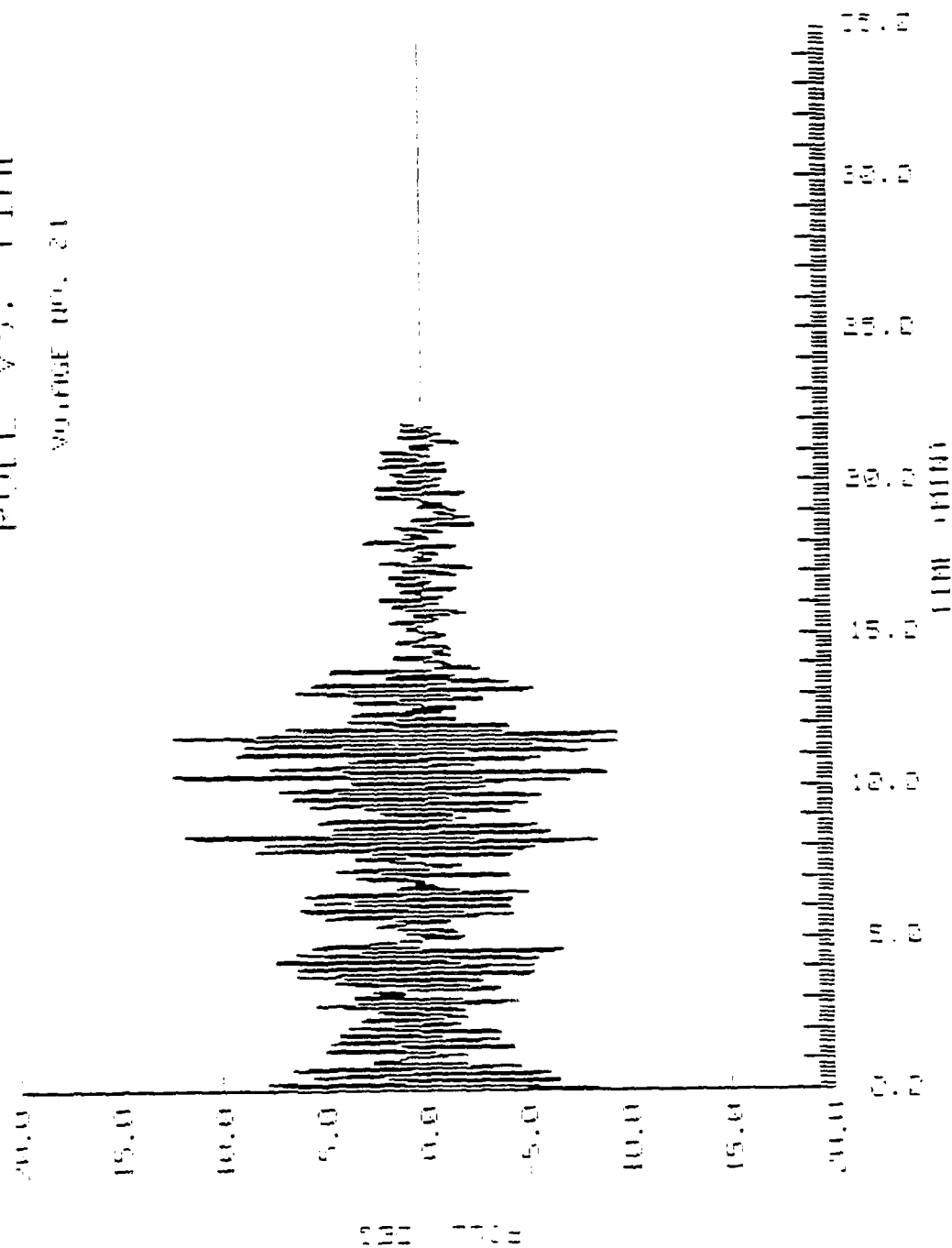
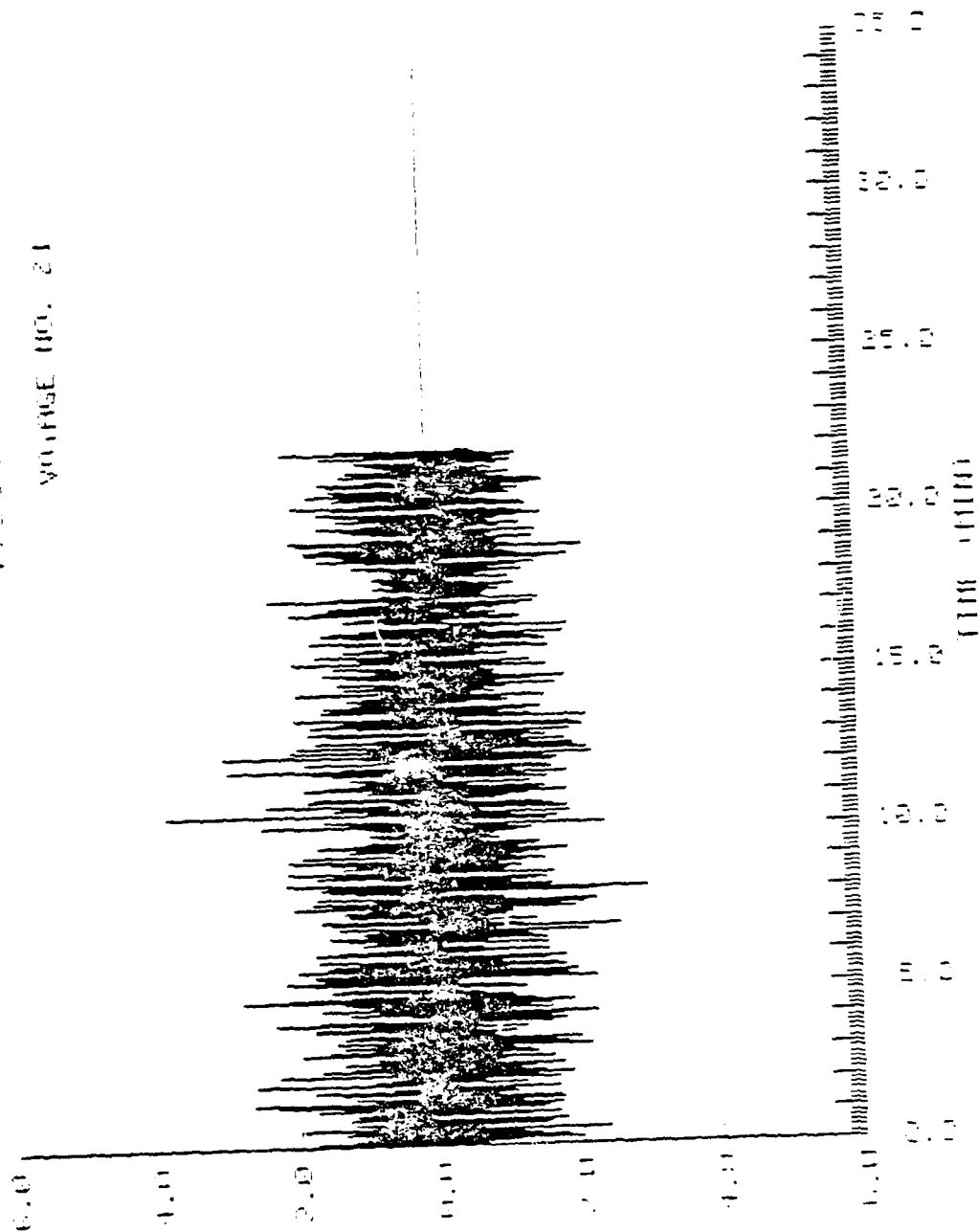




FIG. VS. TIME

YOUNG NO. 21





AD-A098 984

TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

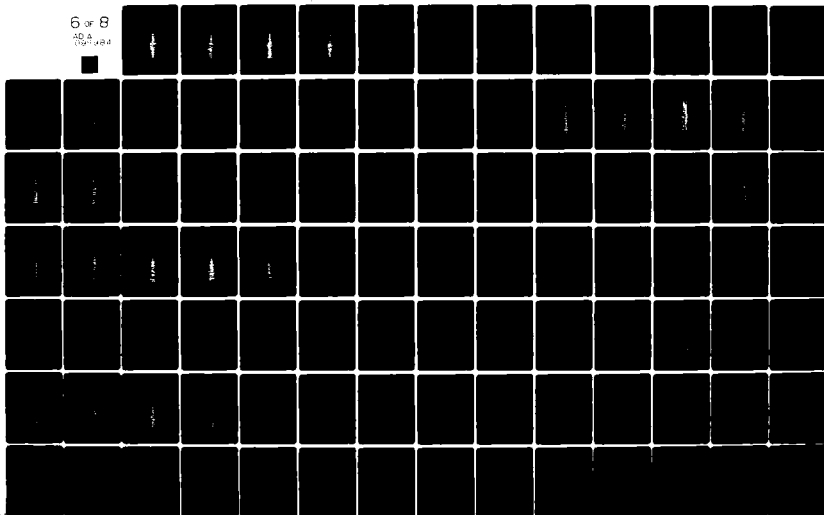
UNCLASSIFIED

TETRAT-TC-3925-APP-A(1)

M.

6 of 8

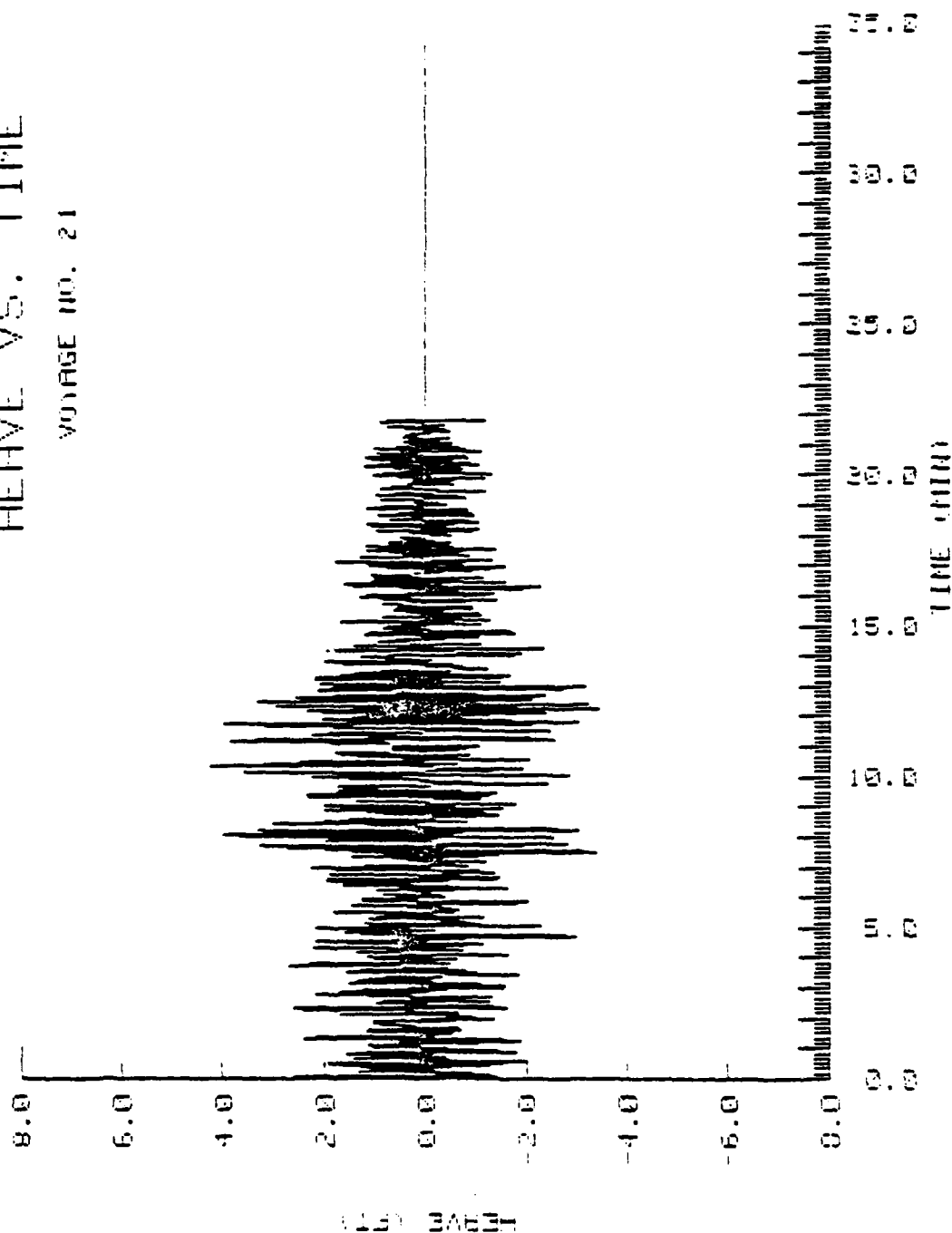
AD-A  
098 984





# HEAVE VS. TIME

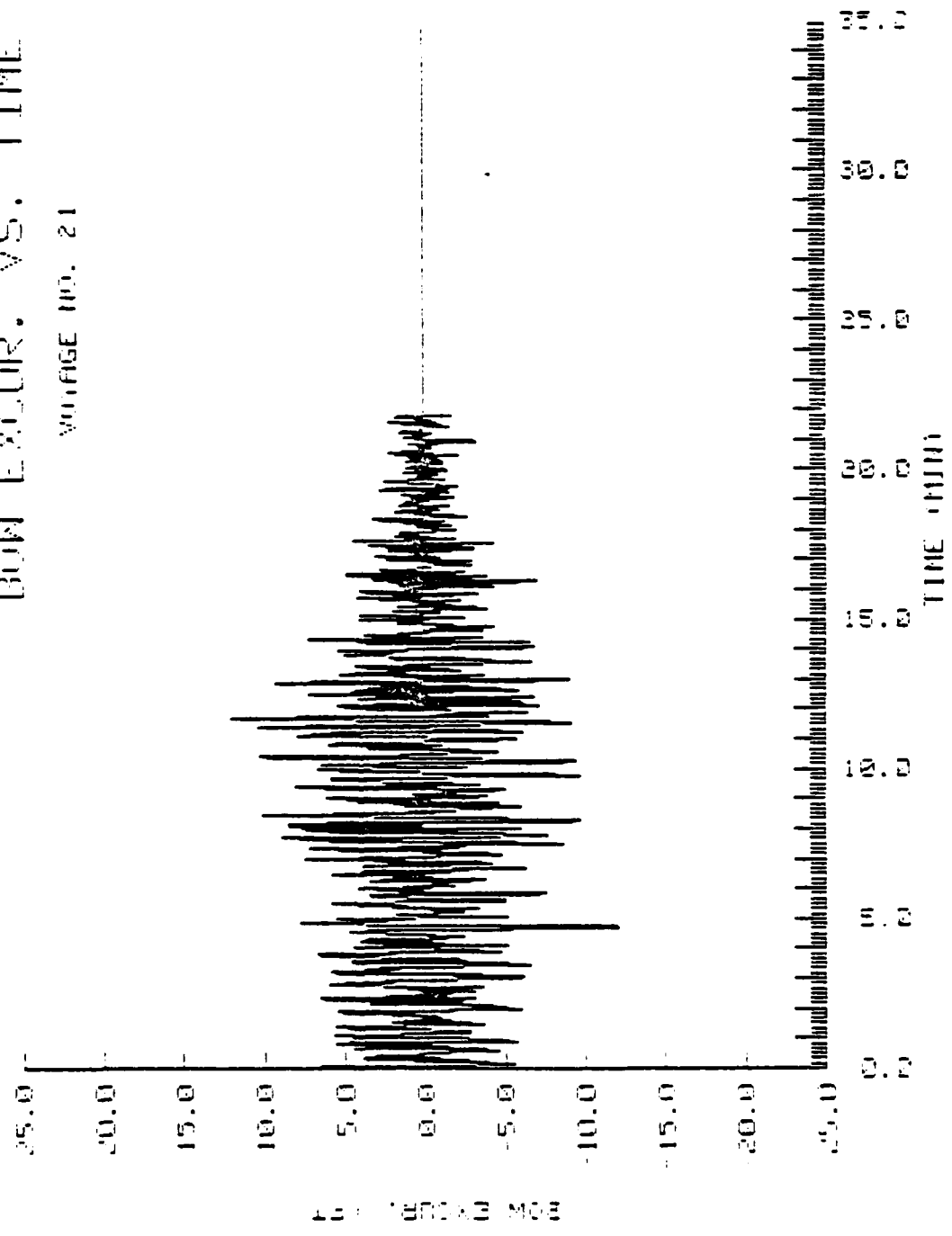
VOYAGE NO. 21





# BOW EXCUR. VS. TIME

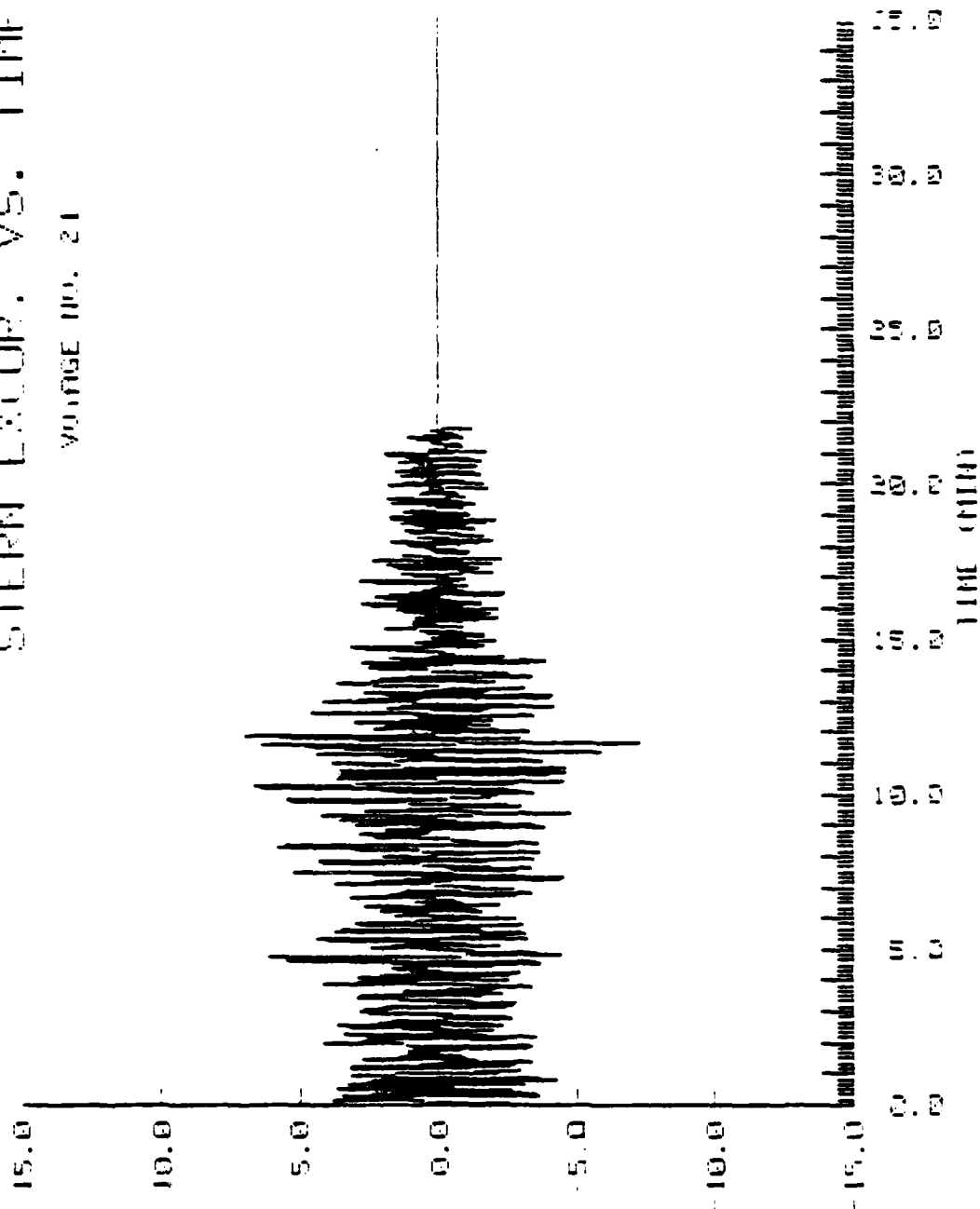
VOLUME NO. 21





# STERN EXCUR. VS. TIME

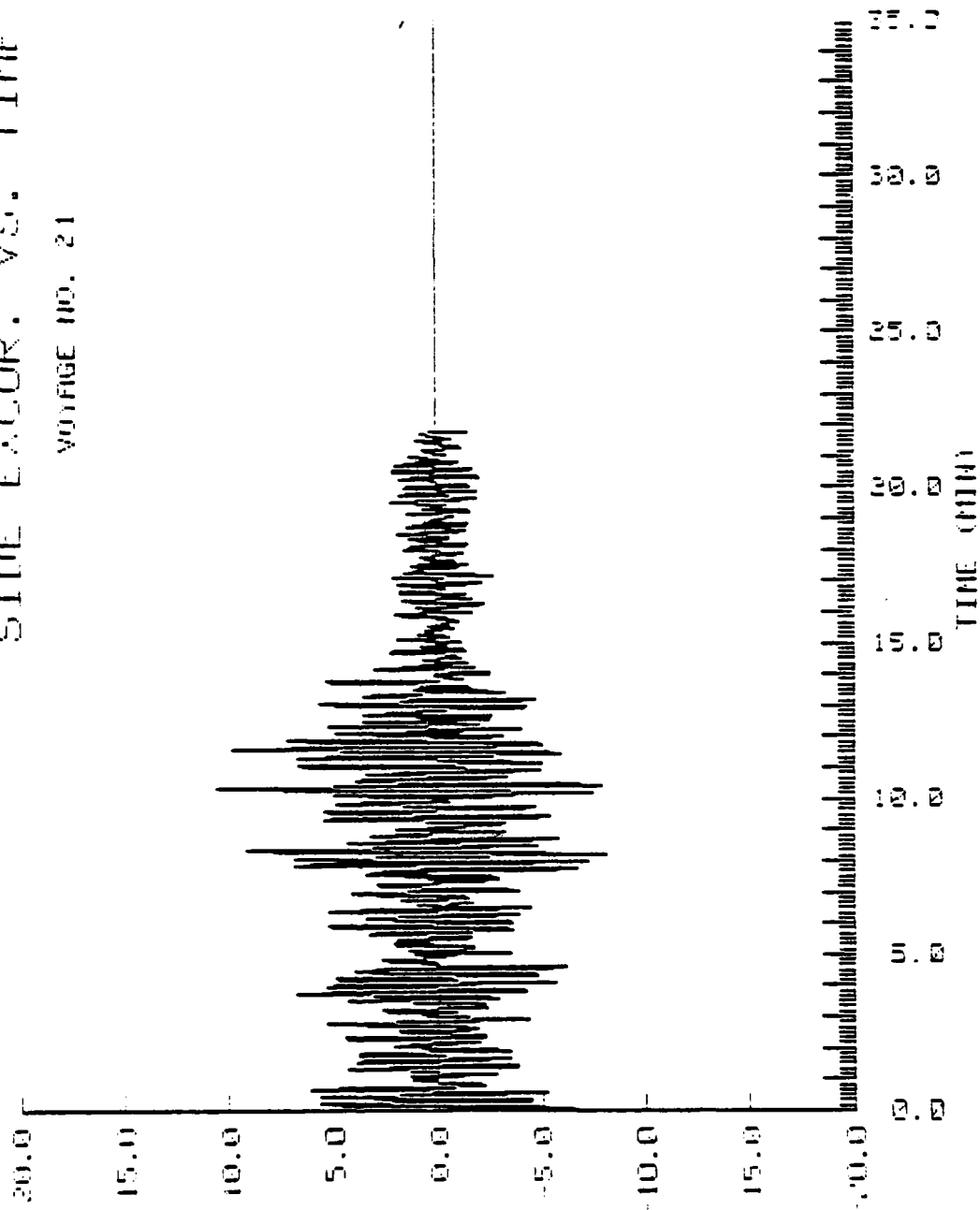
VOLUME NO. 21





SIDE EXCUR. VS. TIME

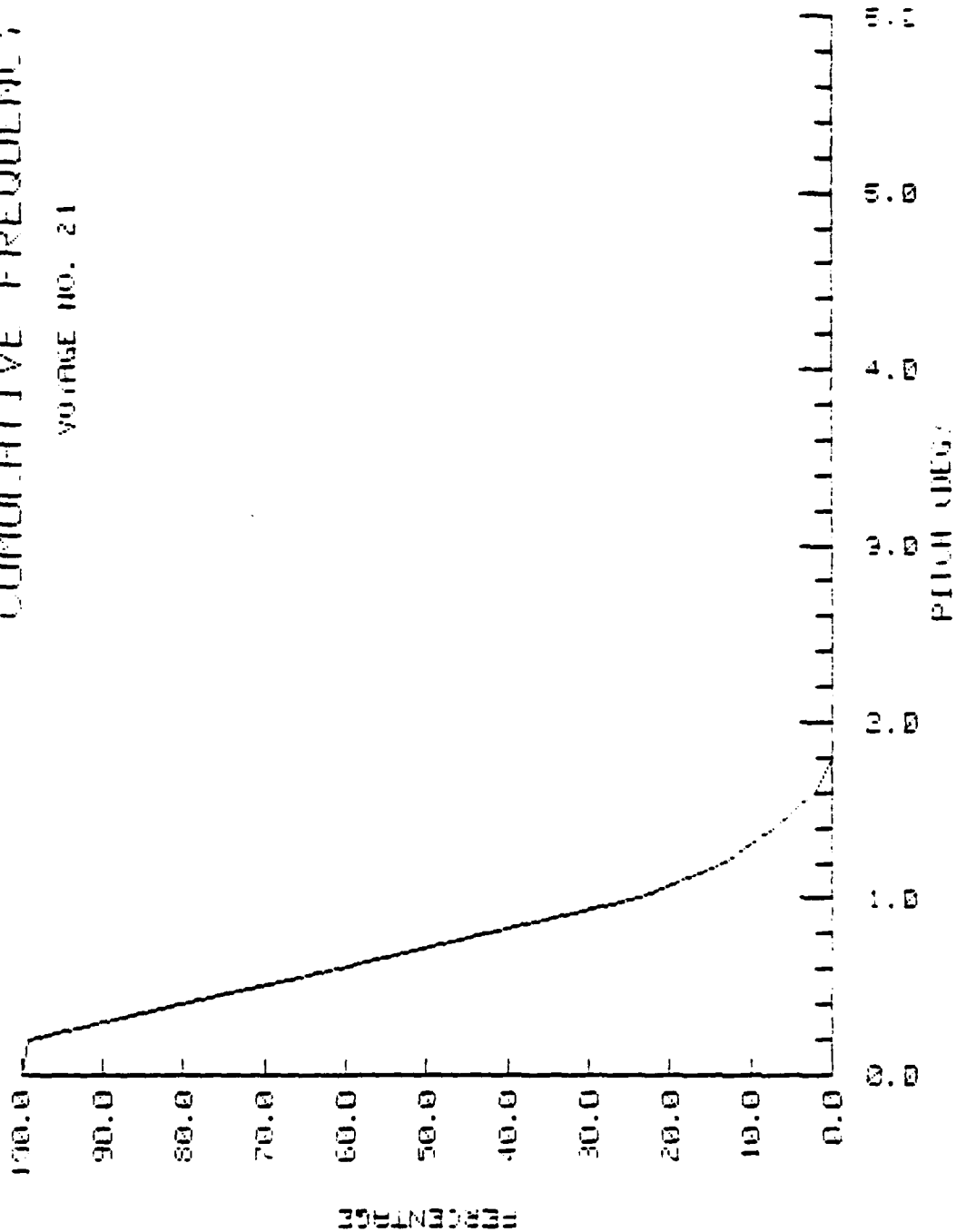
WOTAGE NO. 21





# CUMULATIVE FREQUENCY

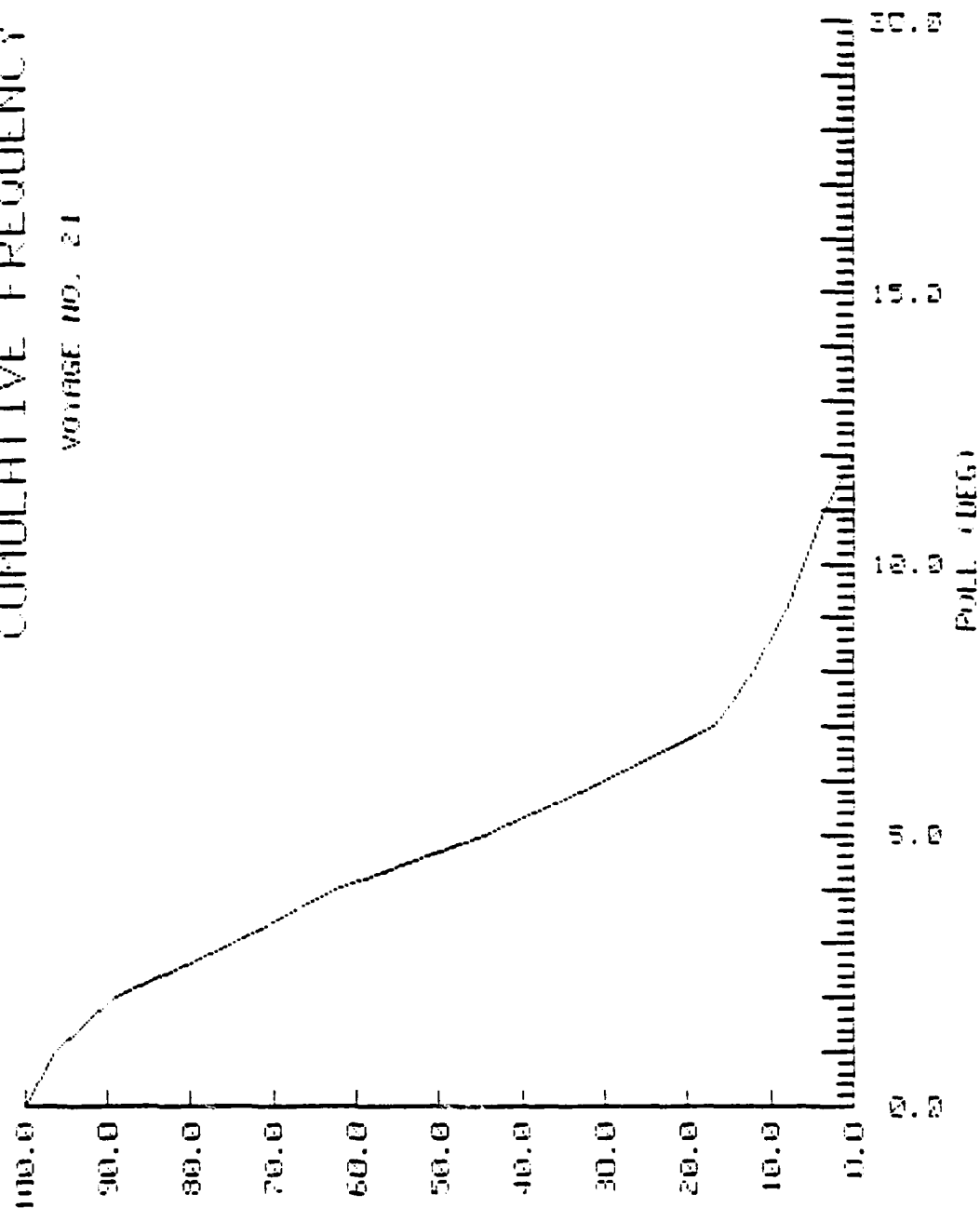
VOLUME NO. 21





# CUMULATIVE FREQUENCY

VOLAGE NO. 21

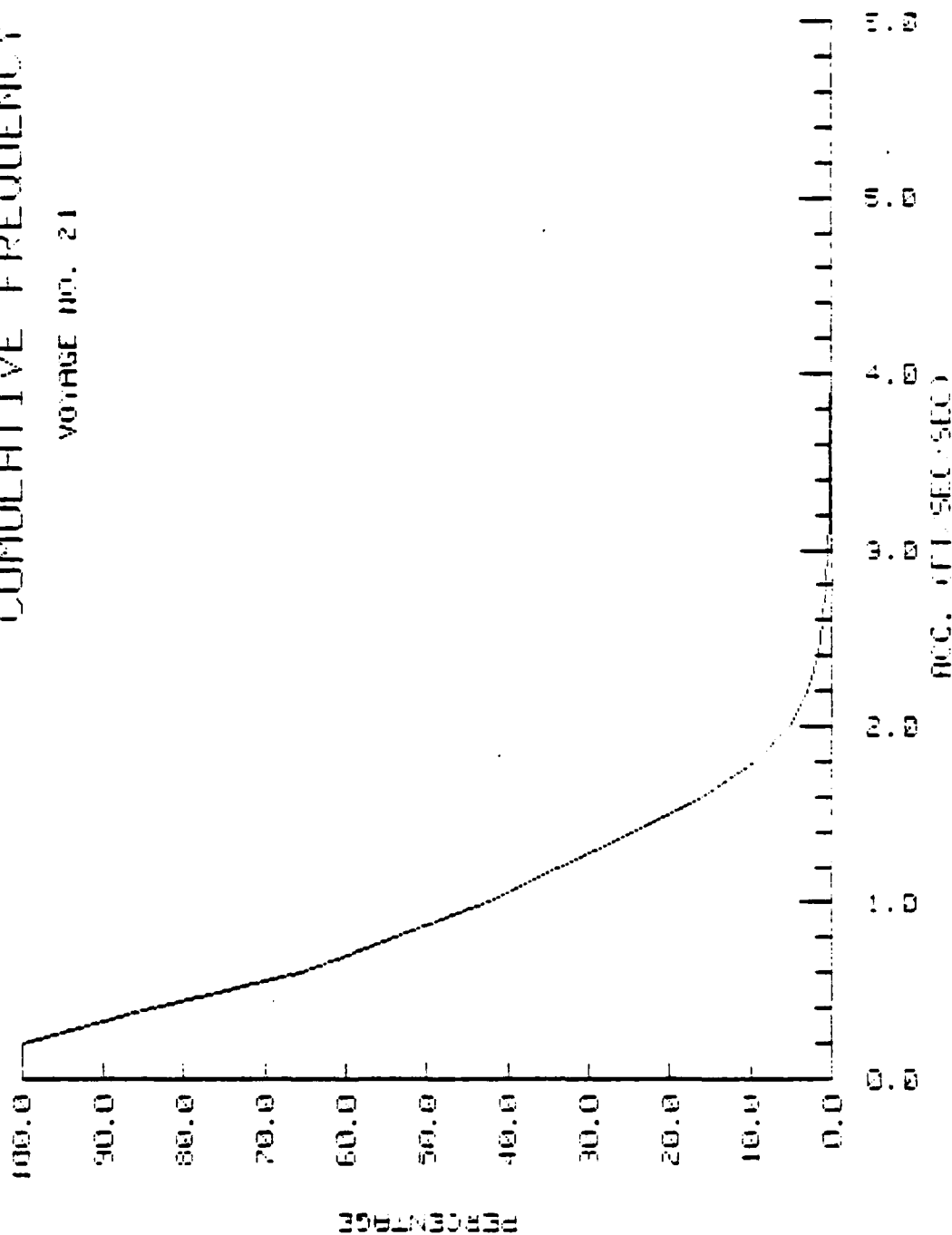


3561N30636



# CUMULATIVE FREQUENCY

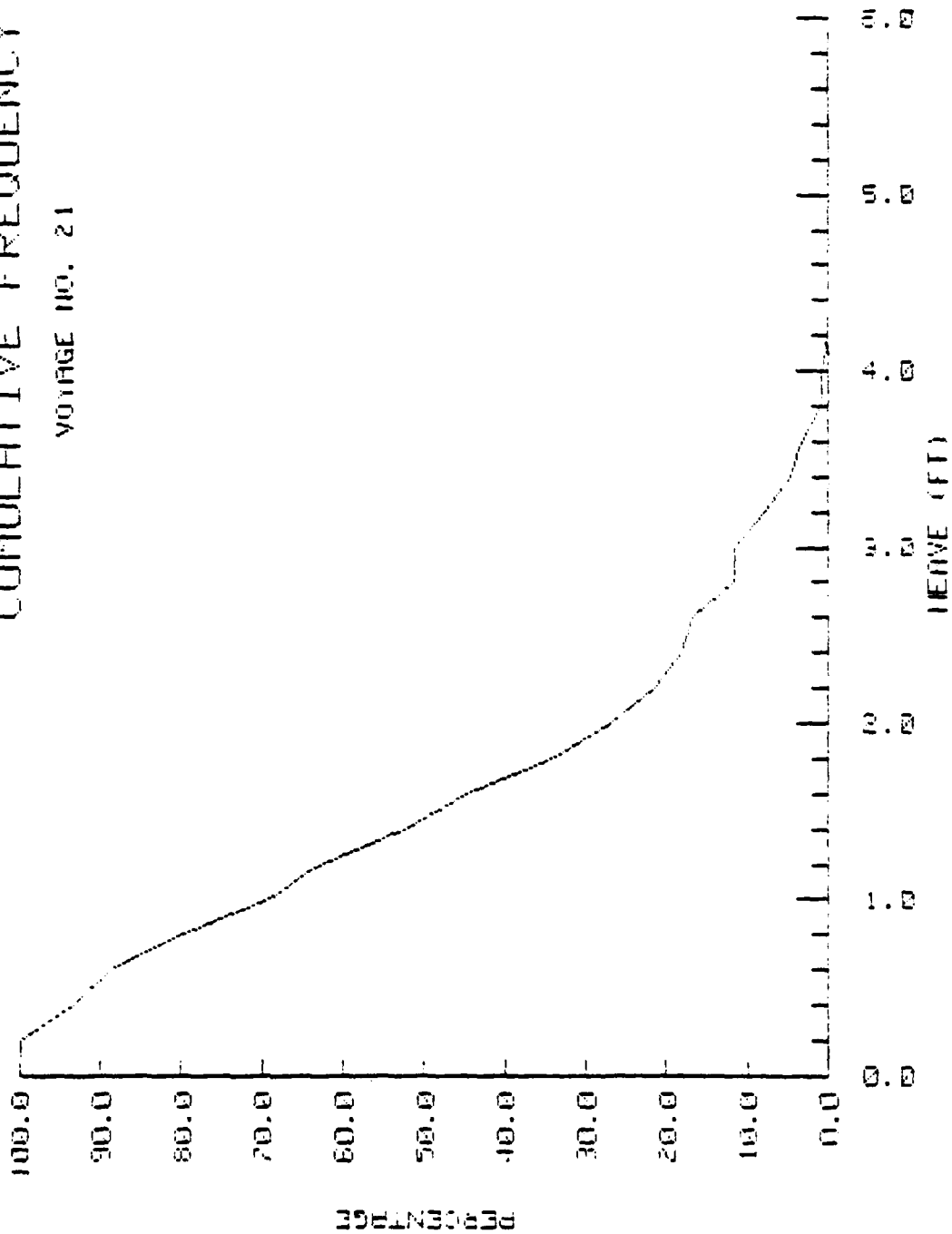
VOLTAGE NO. 21





# CUMULATIVE FREQUENCY

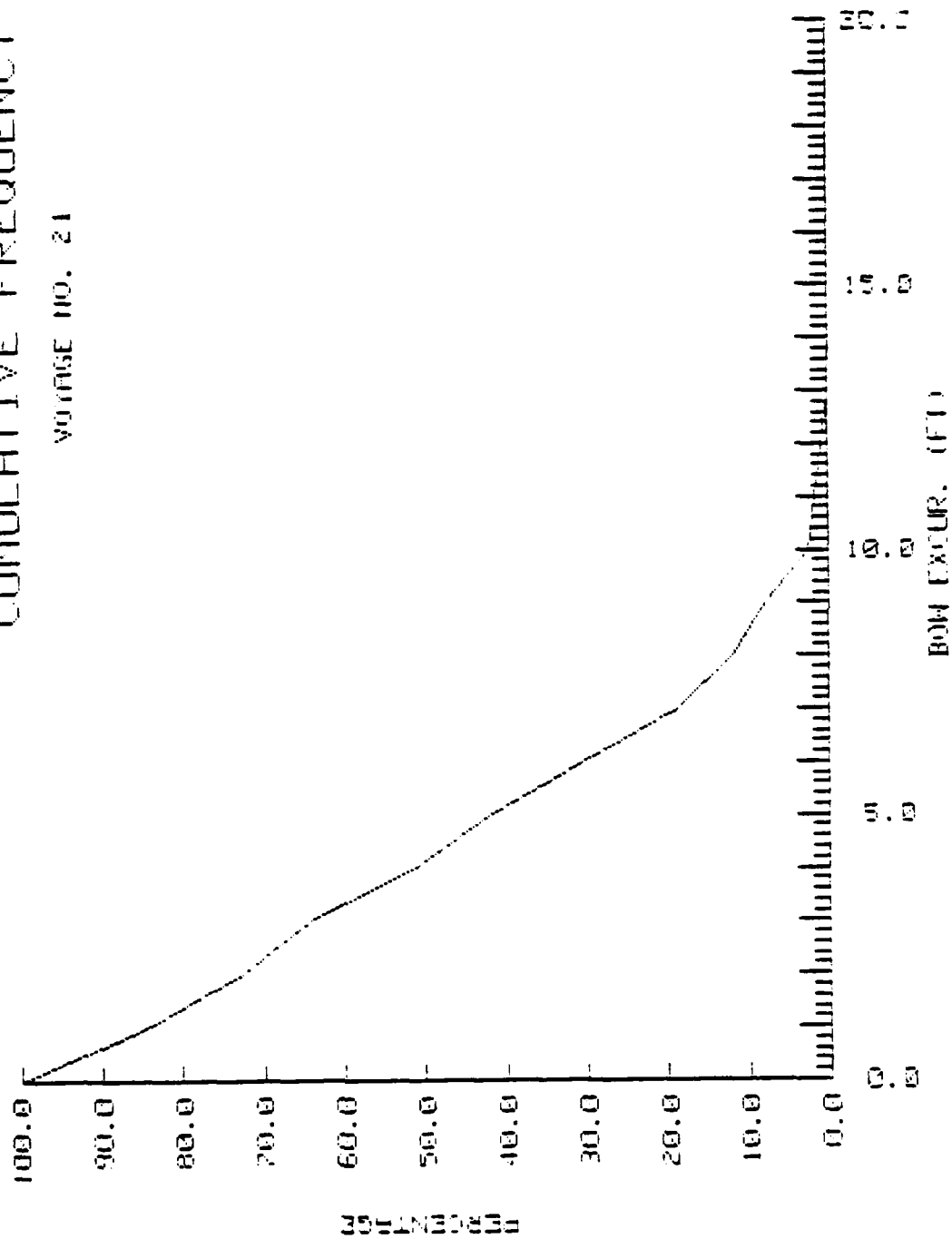
VOLTAGE NO. 21





# CUMULATIVE FREQUENCY

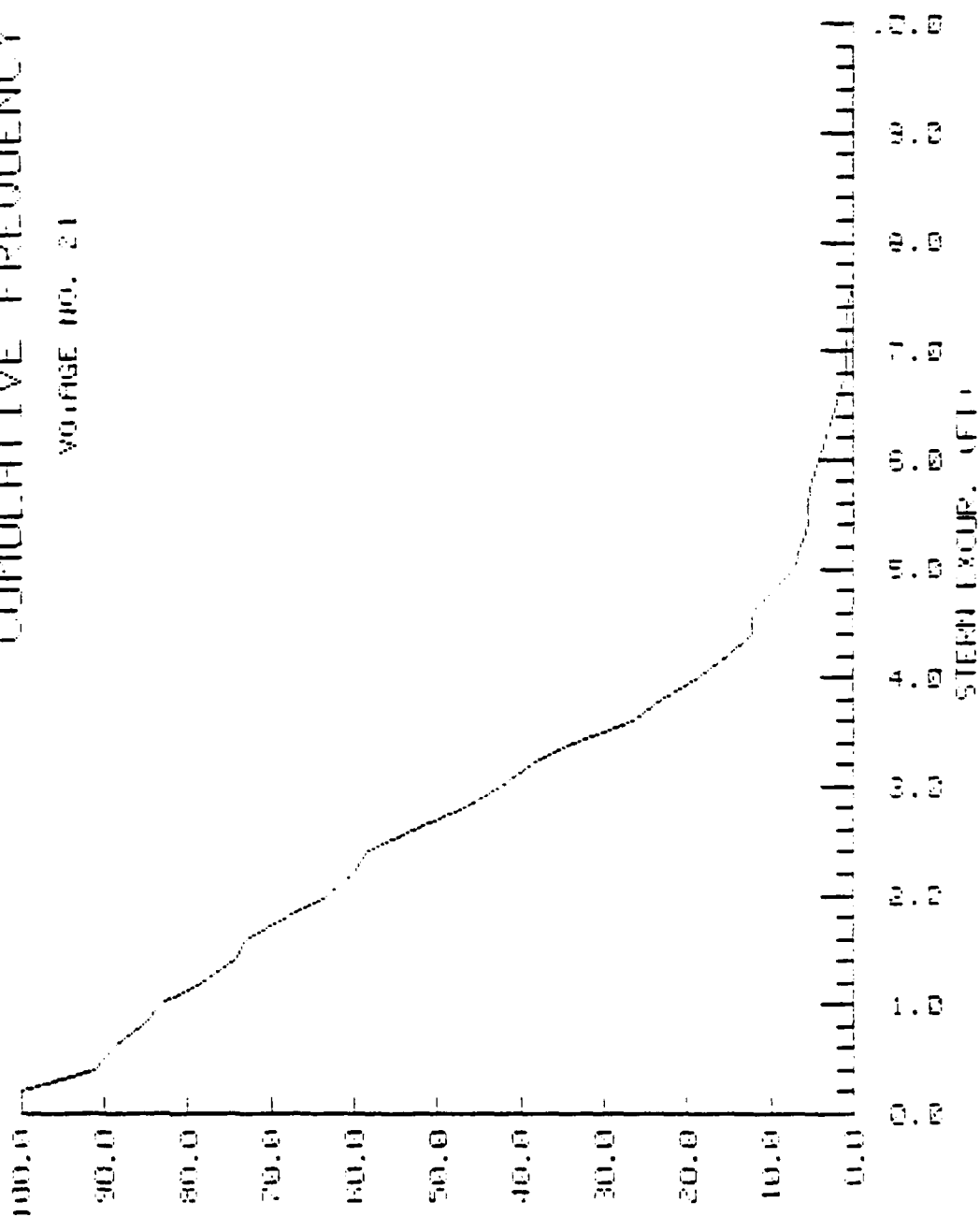
VORAGE NO. 21





# CUMULATIVE FREQUENCY

VOYAGE NO. 21

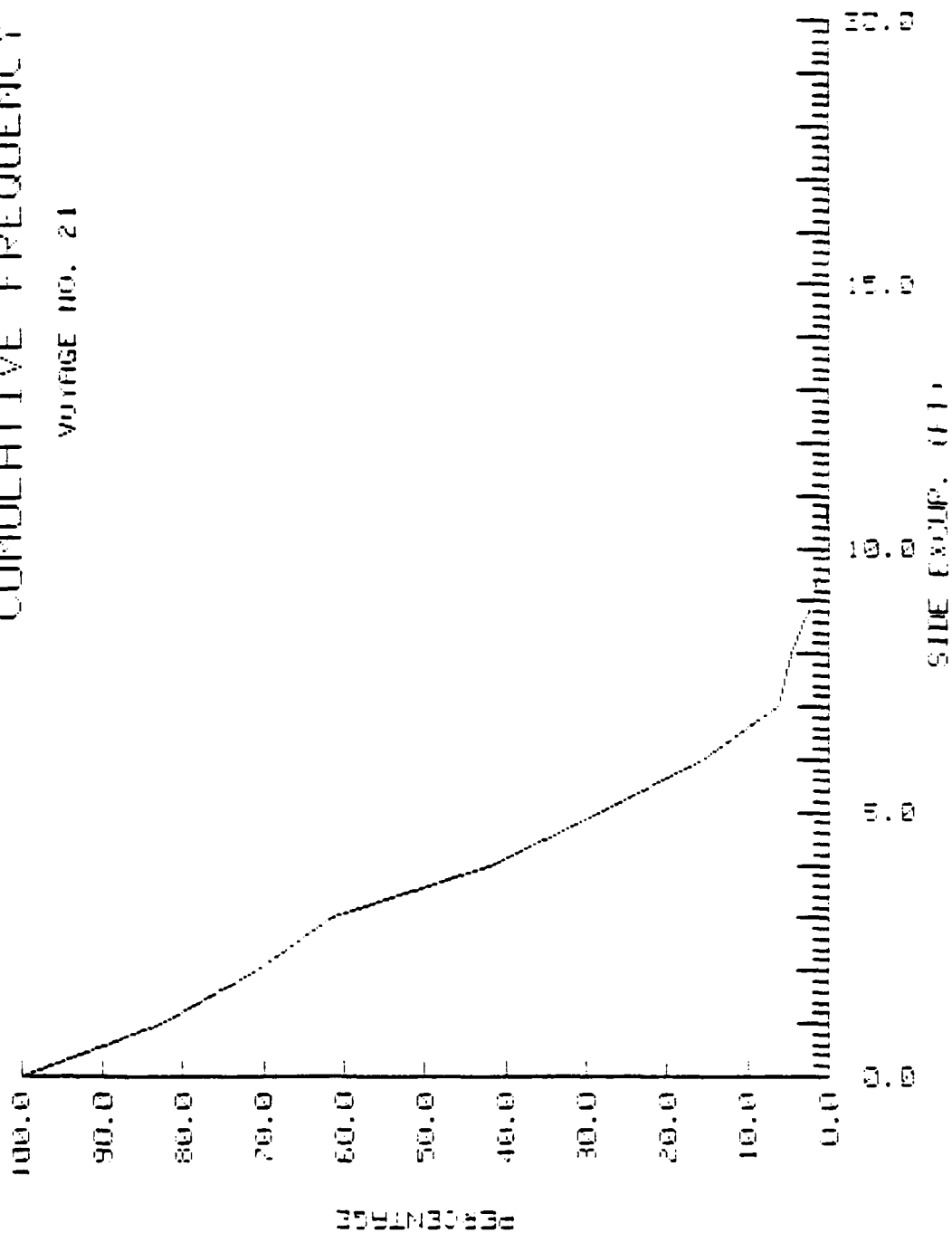


05 12 50 00



# CUMULATIVE FREQUENCY

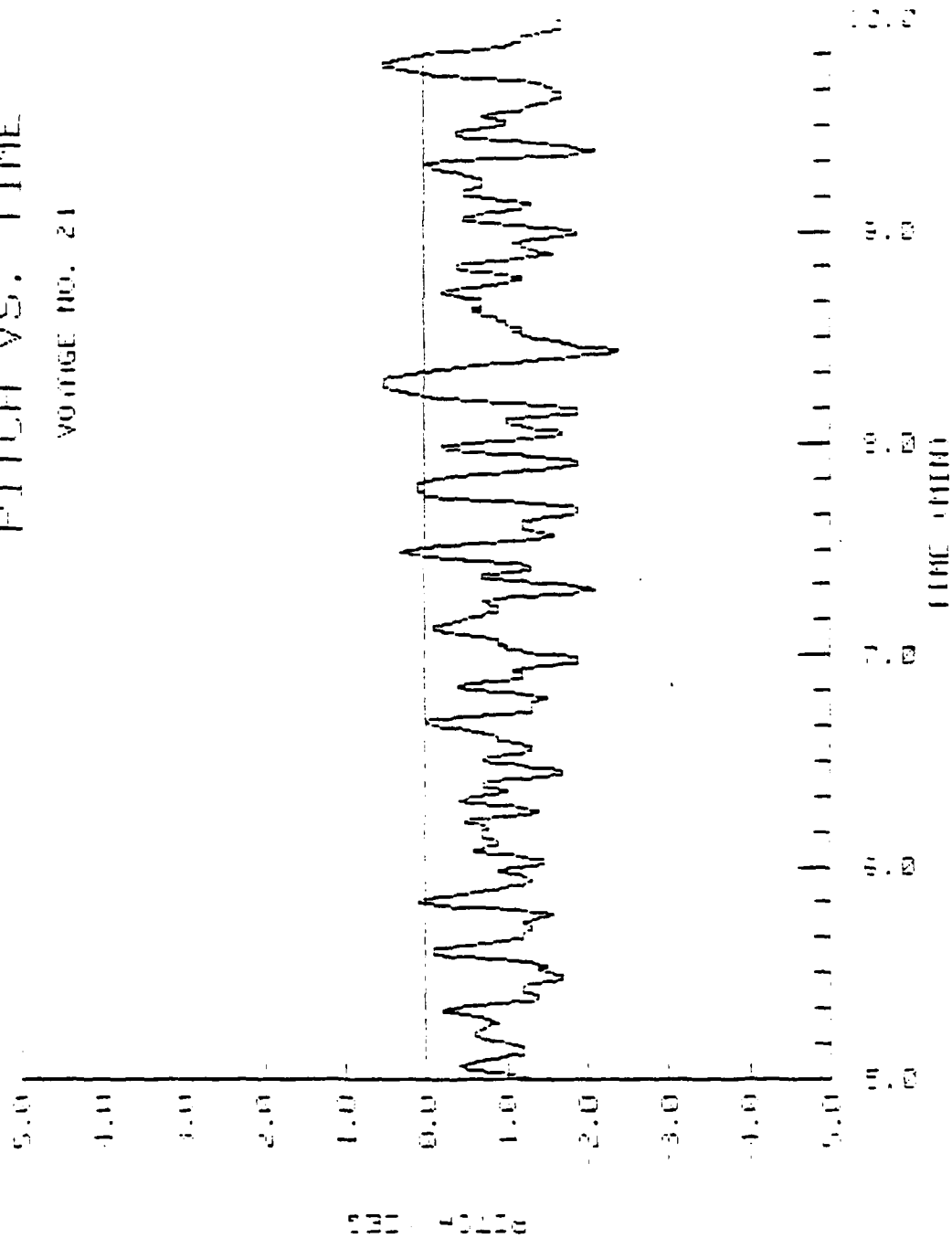
VORISE NO. 21





# PITCH VS. TIME

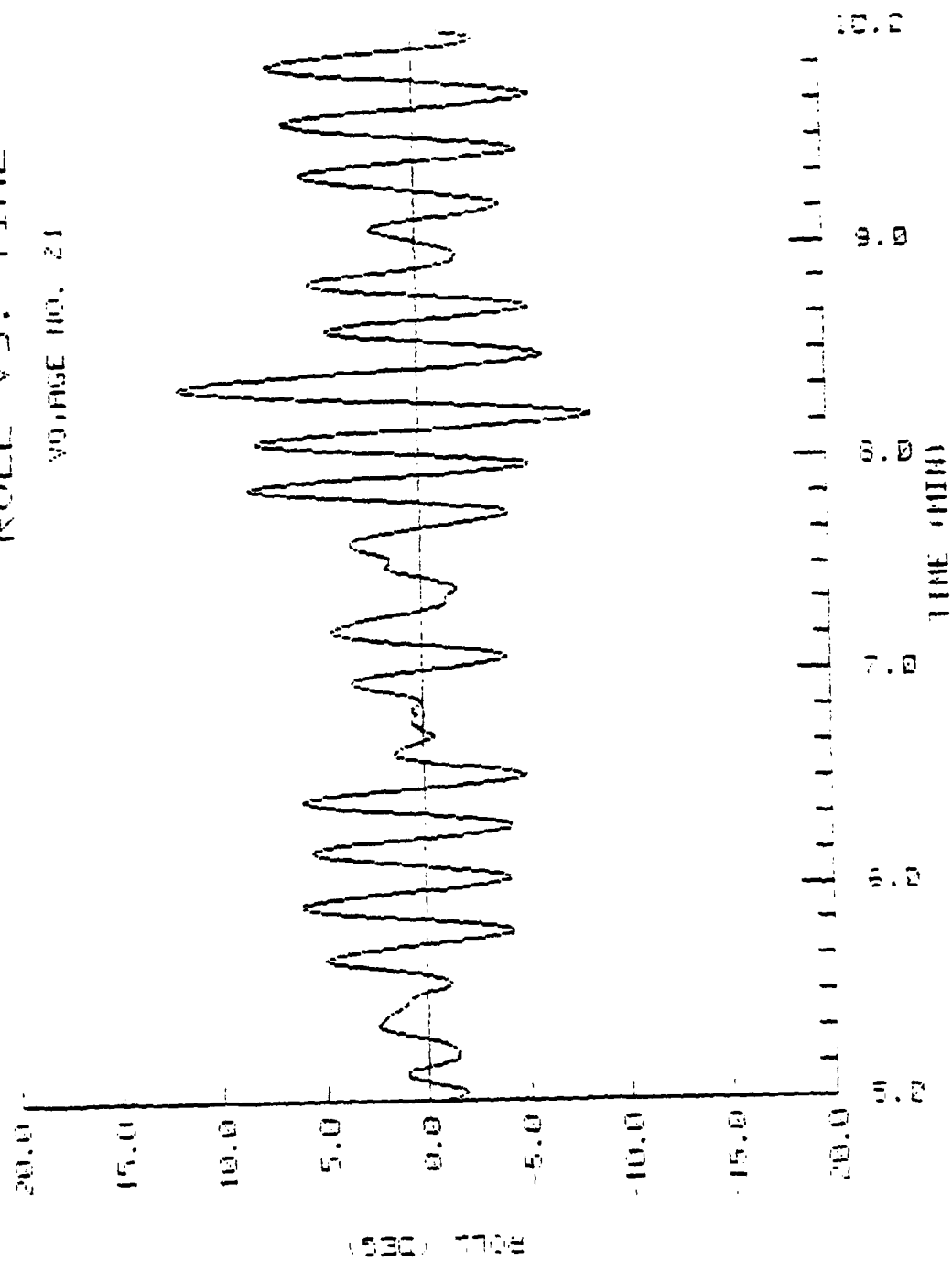
VOLUME NO. 21





# ROLL VS. TIME

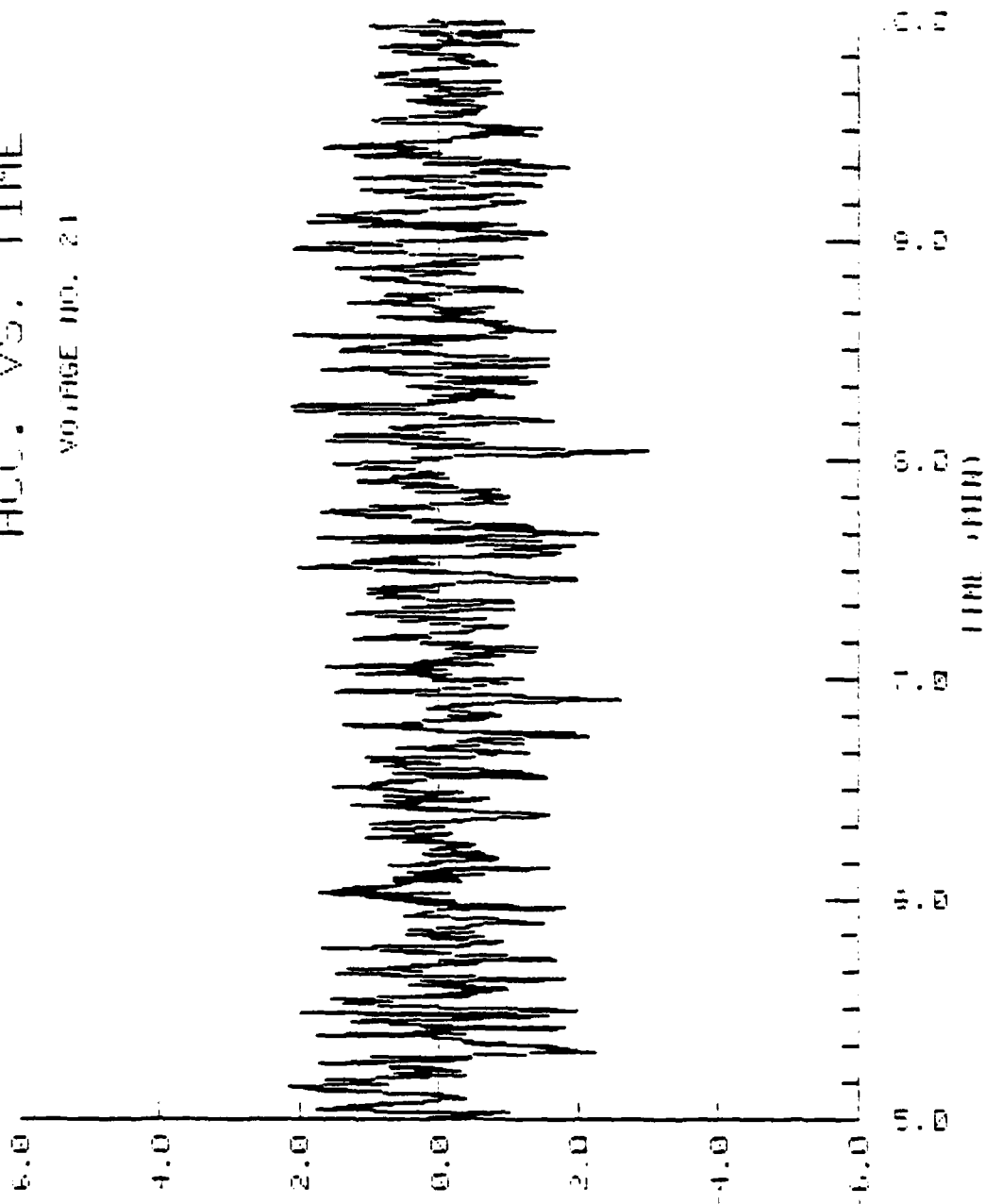
VOLUME NO. 21





ACC. VS. TIME

VOLUME NO. 21

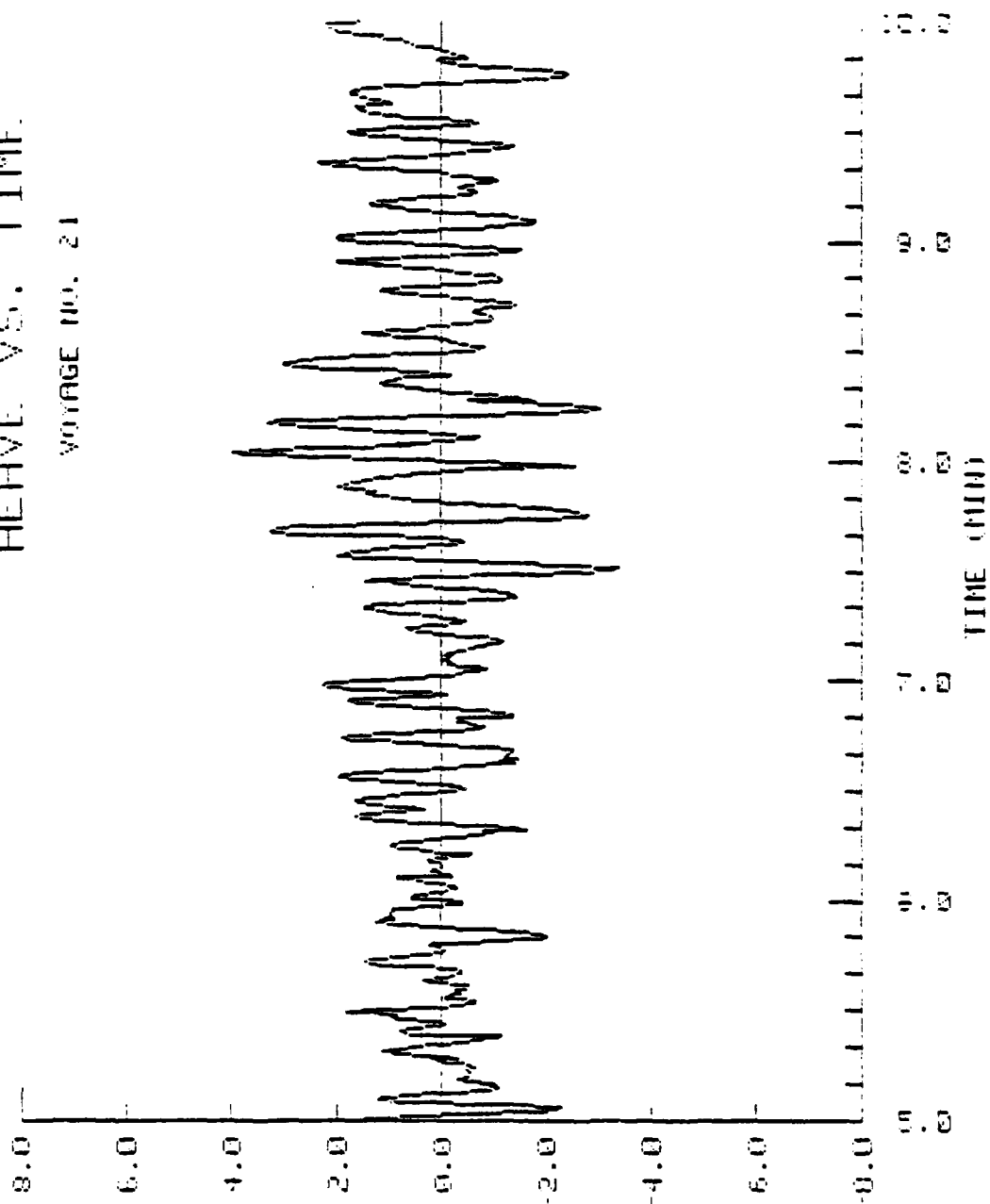


ACC. VS. TIME



# HEAVE VS. TIME

VOTAGE NO. 21

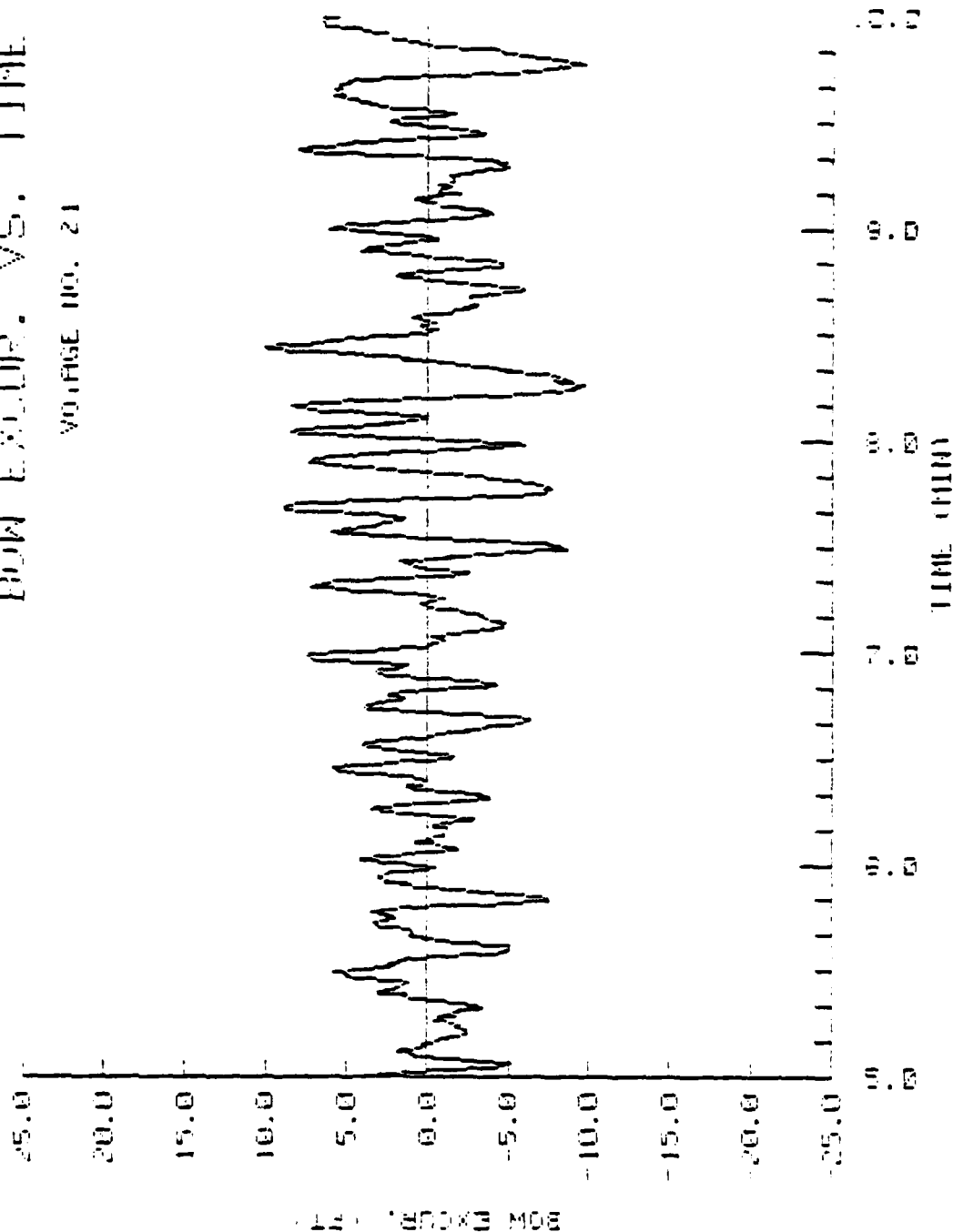


11-30-67



# EDW EXCUR. VS. TIME

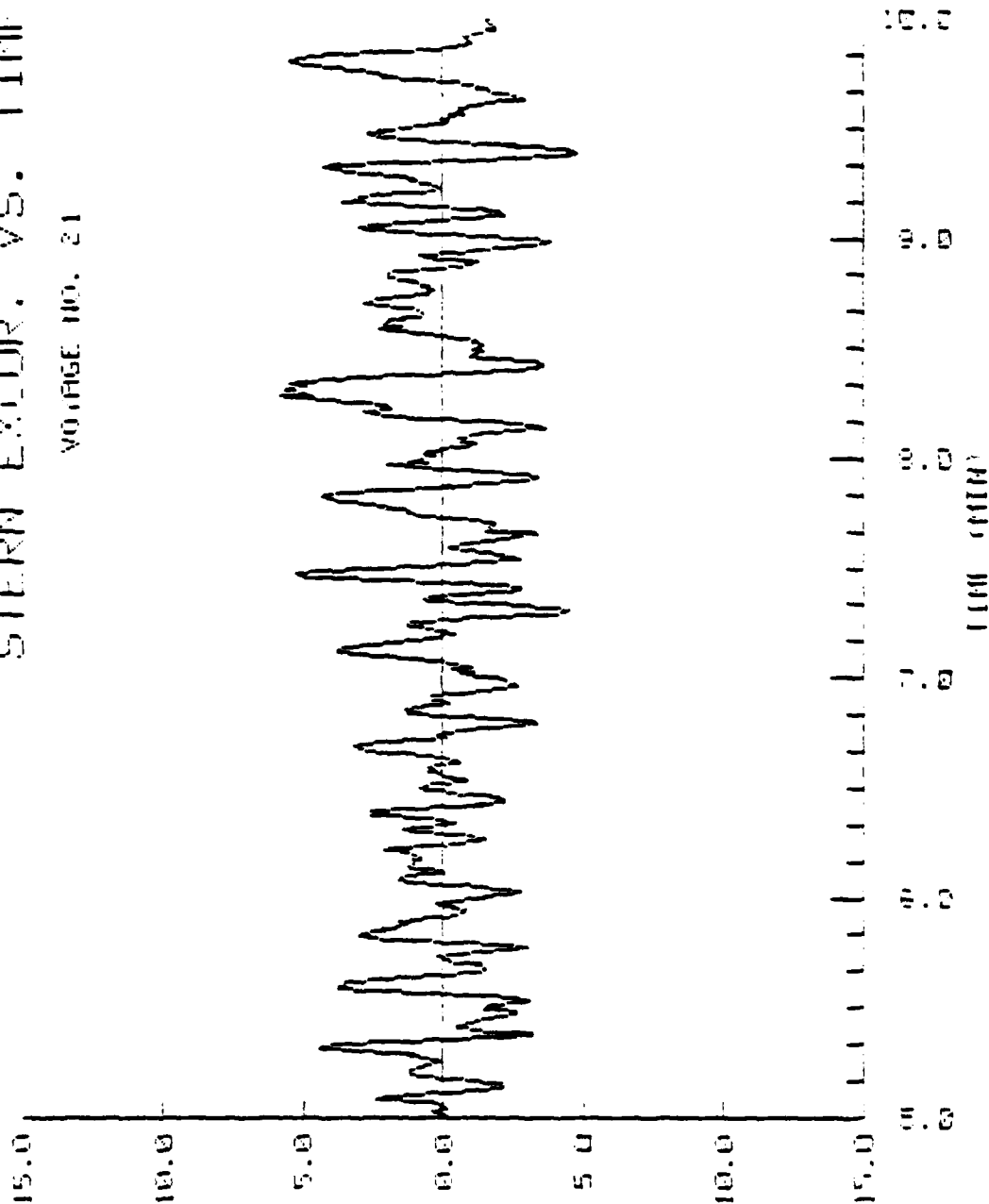
VOLUME NO. 21





STERN EXCUR. VS. TIME

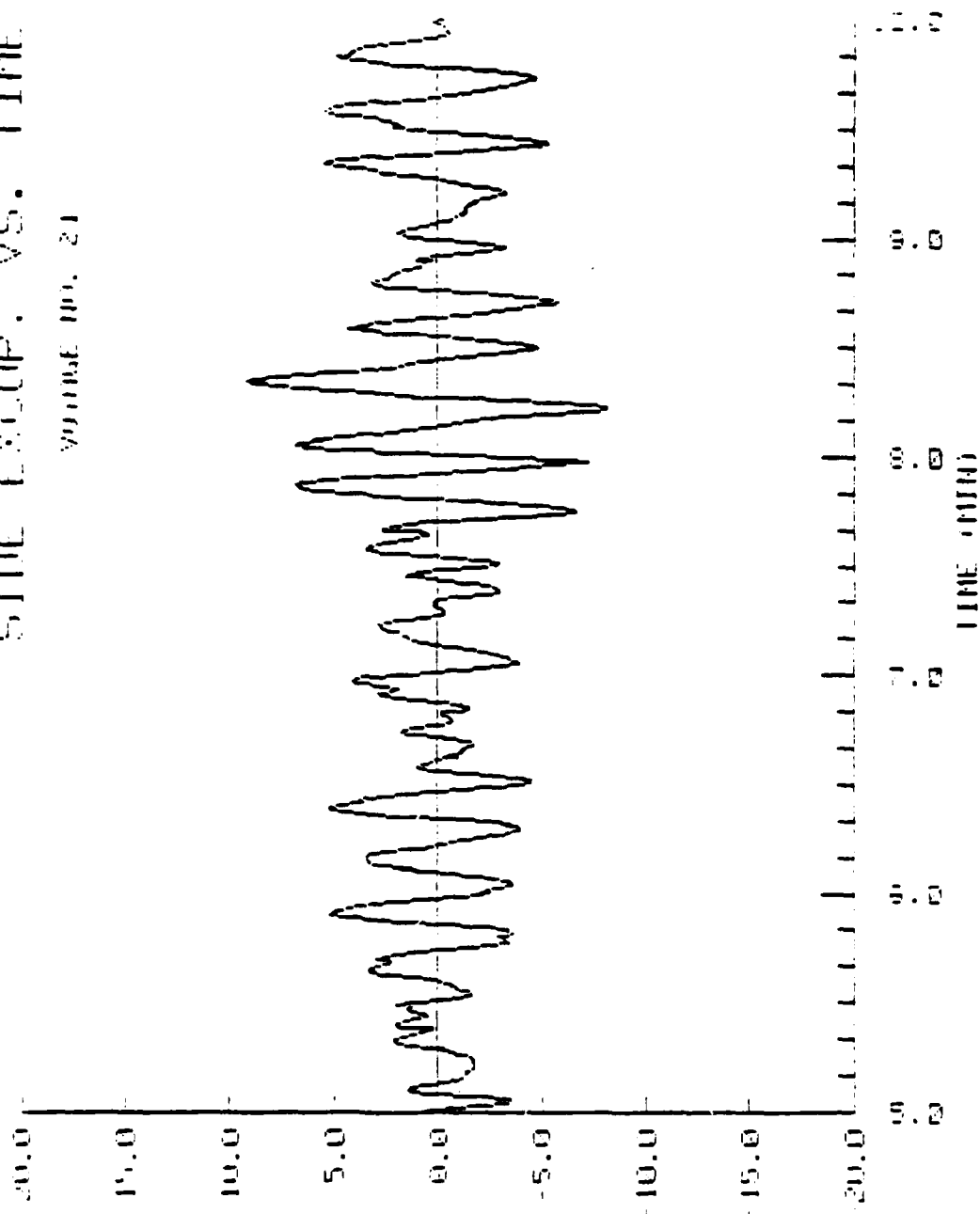
VOLTAJE NO. 21





THE LUCKY. VS. THE

12-111-100



2013. 2013. 2013.



# STATISTICAL SUMMARY

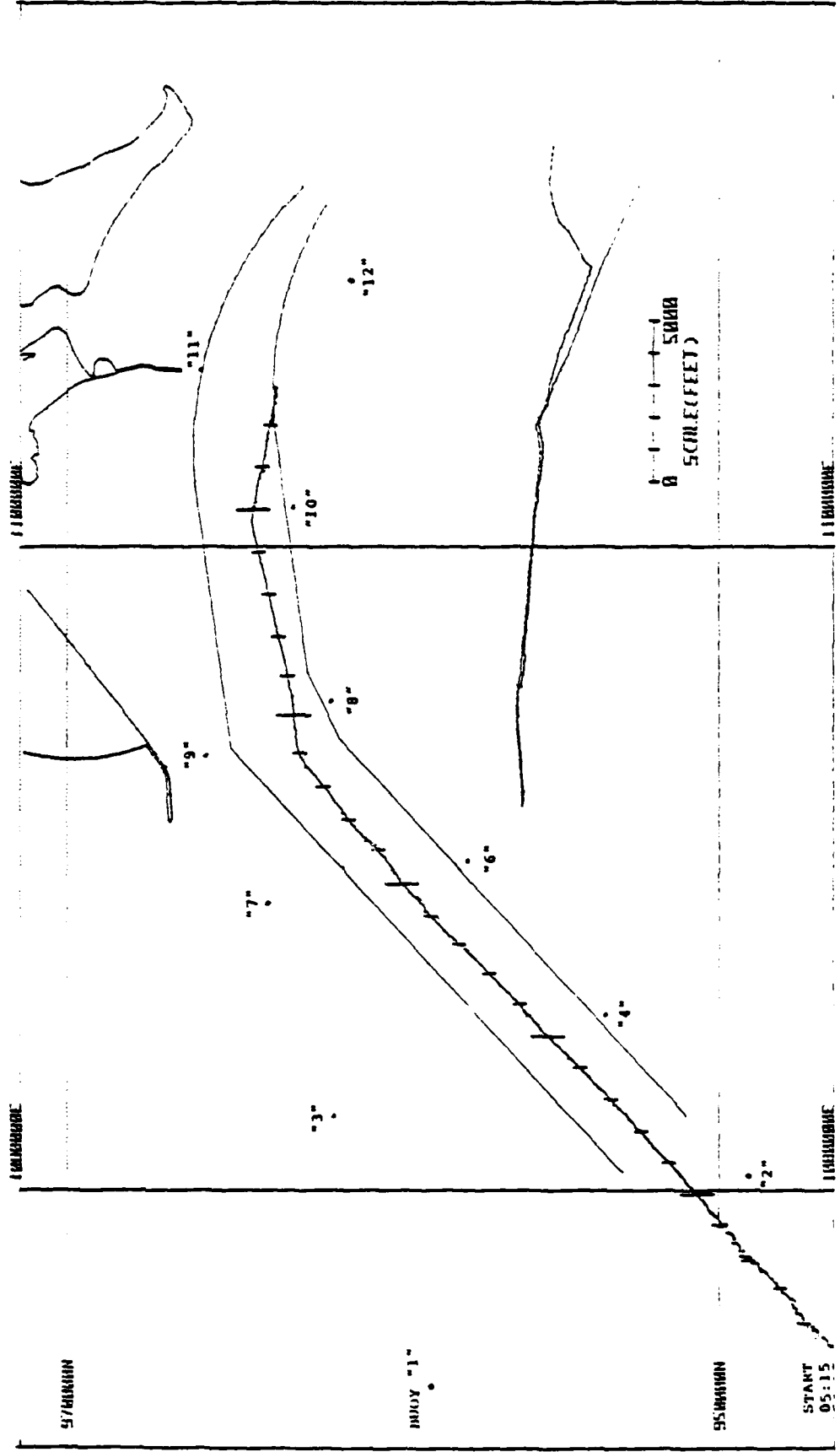
VOTAGE NO. 22

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG.)	.2	1.5	.6	.7
ROLL (DEG.)	1.4	8.1	3.1	3.5
YAW (FT PER SEC)	.1	3.6	1.0	1.2
HEAVE (FT)	.1	3.8	1.2	1.4
ROLL EXCUR. (FT)	.1	11.8	4.2	5.1
YAW EXCUR. (FT)	.1	6.9	2.3	2.7
HEAVE EXCUR. (FT)	.1	7.0	2.9	3.3



# VOYAGE NO. 22 SHIP TRACK

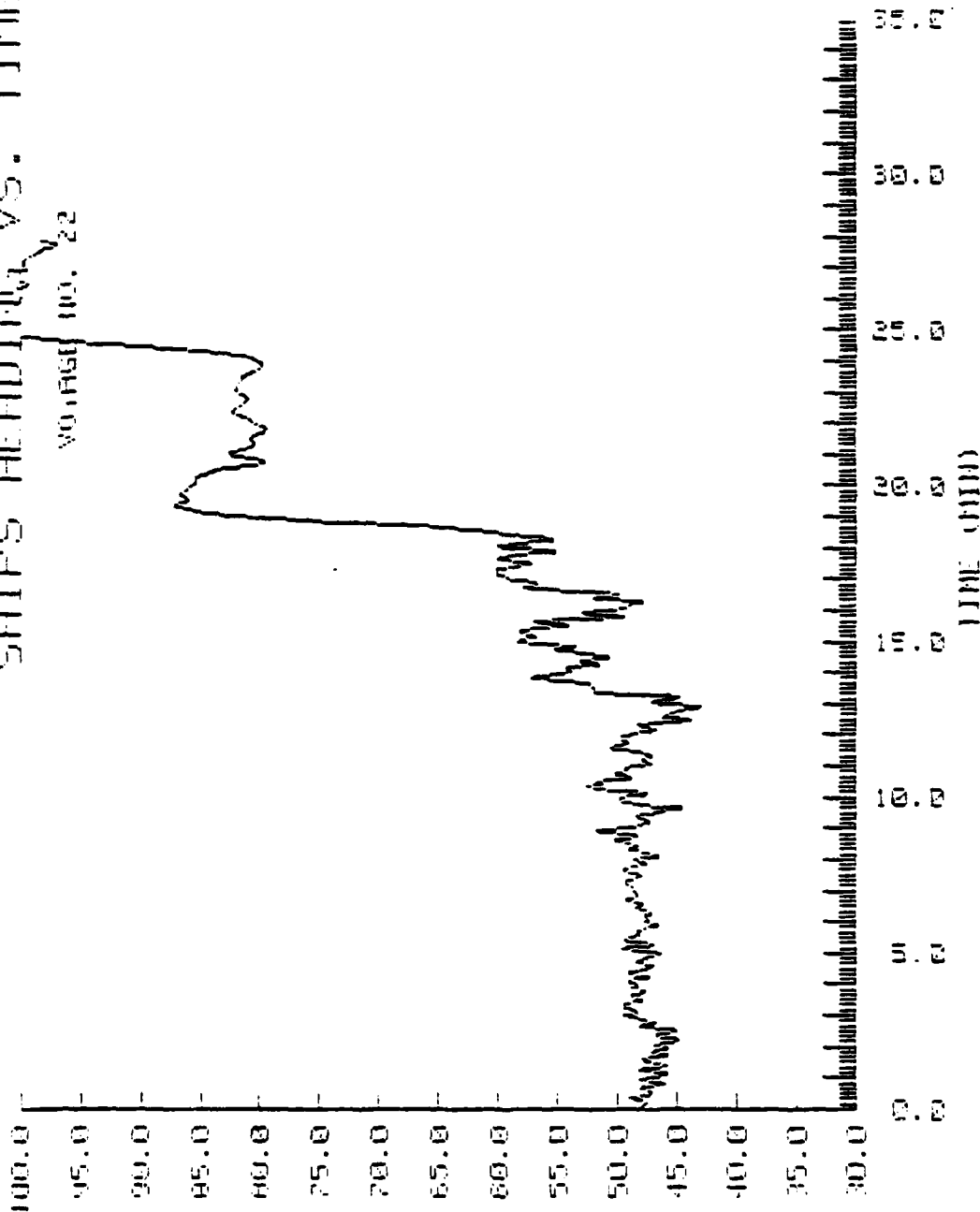
SCALE 1:20000





# SHIPS HEADING VS. TIME

VO. 1851 100. 22



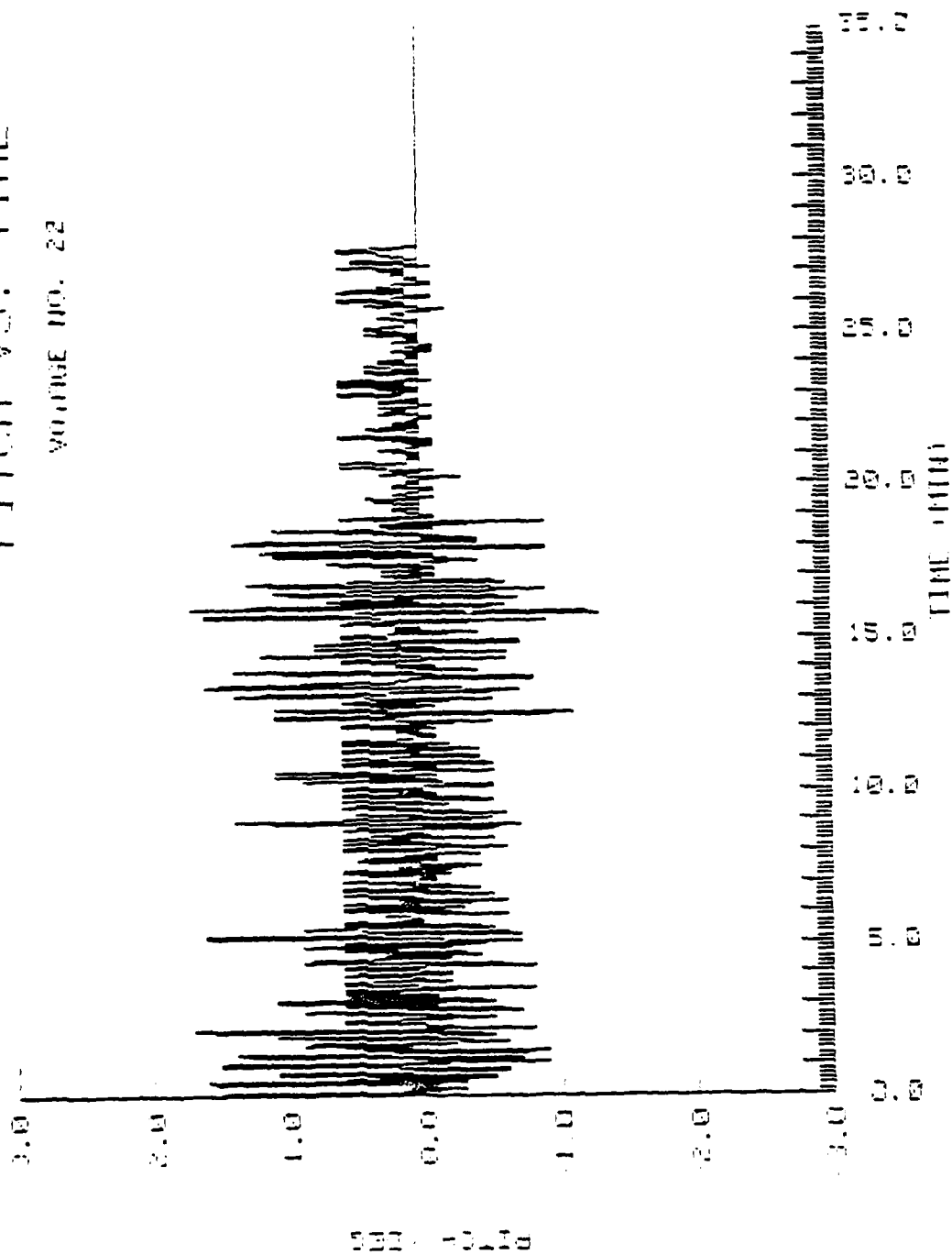
100.0 95.0 90.0 85.0 80.0 75.0 70.0 65.0 60.0 55.0 50.0 45.0 40.0 35.0 30.0

TIME (MIN)



# PITCH VS. TIME

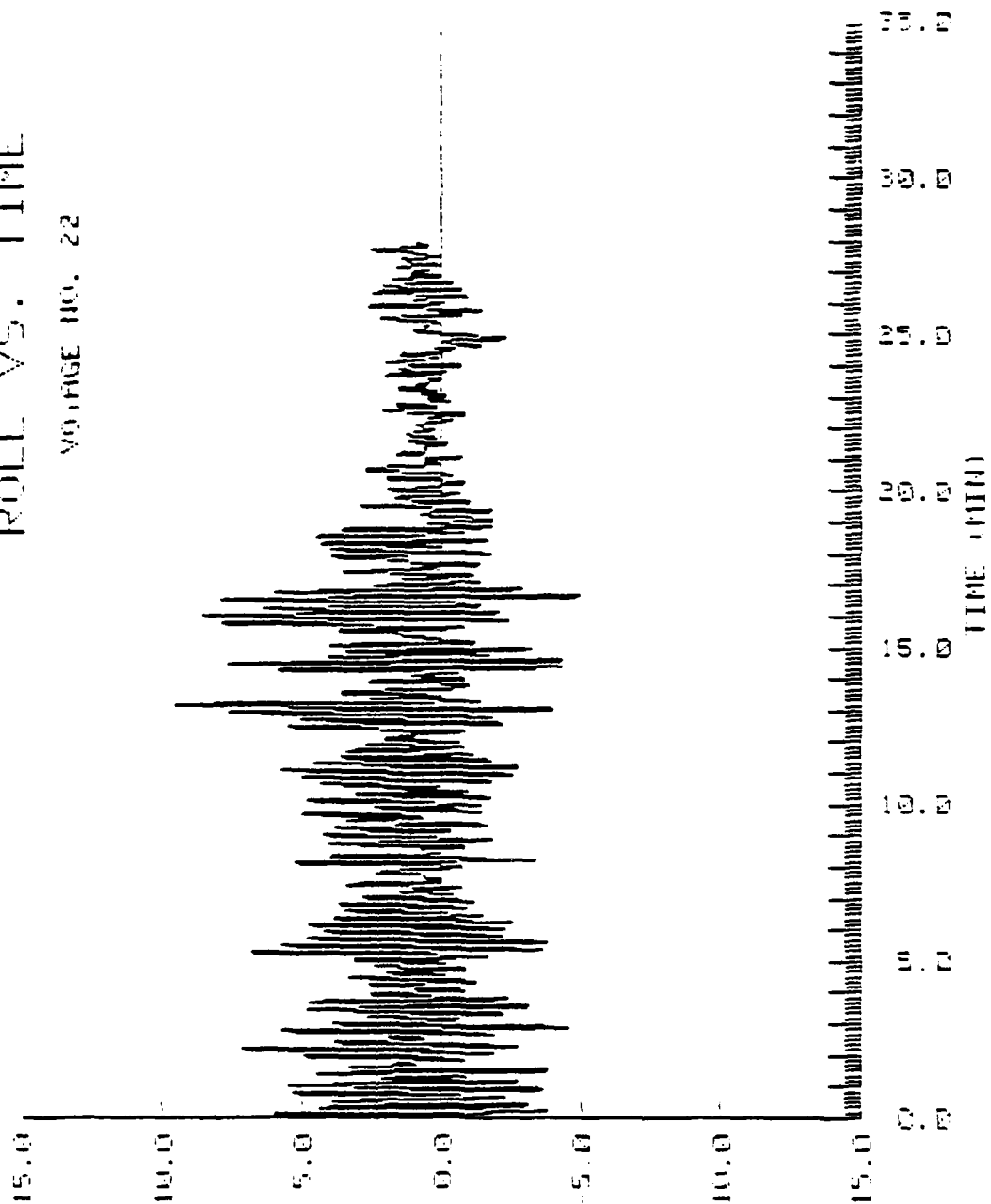
VOICE NO. 22





# ROLL VS. TIME

VOLUME NO. 22

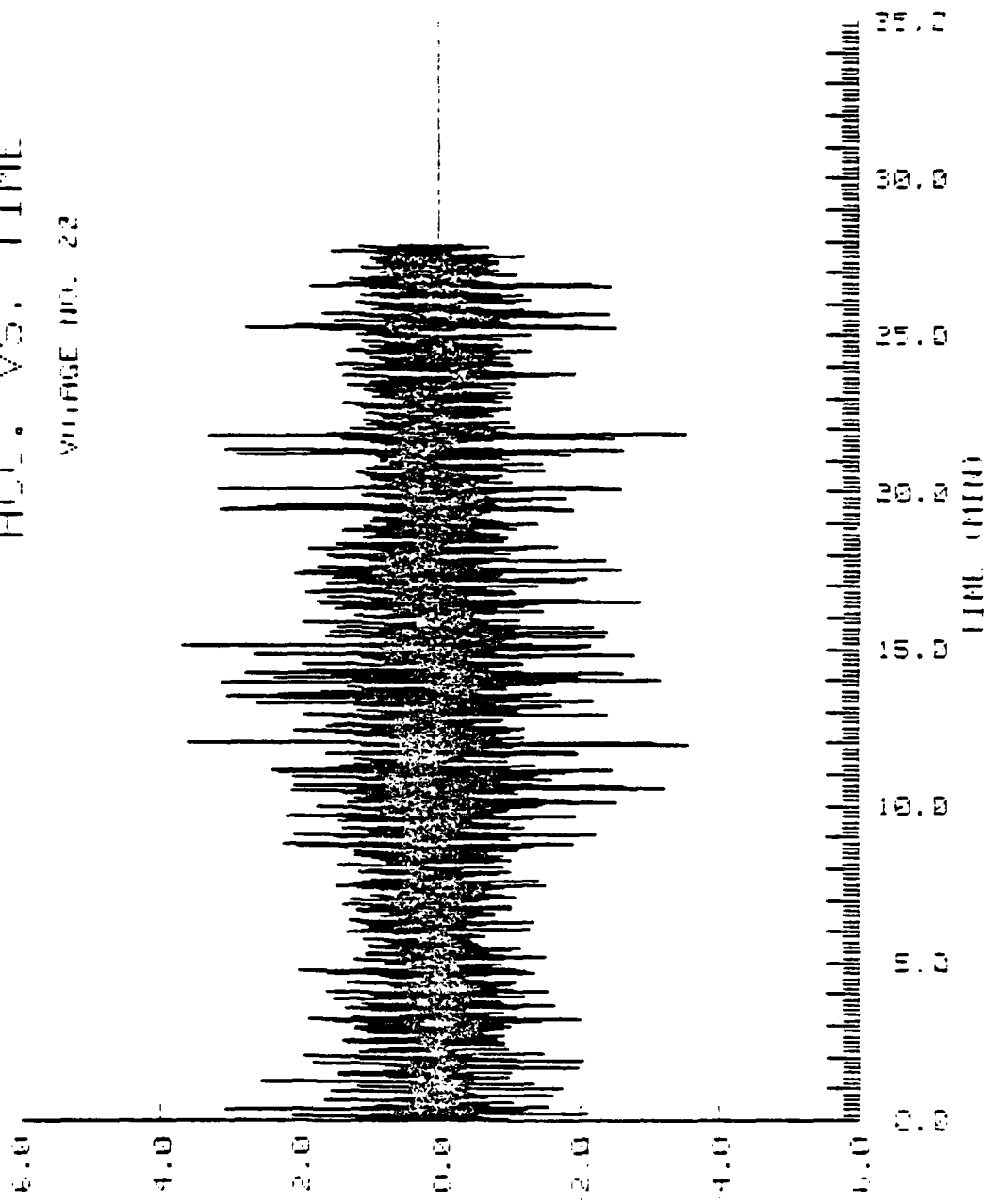


1968-1969



# ACC. VS. TIME

VOL. 100. 22

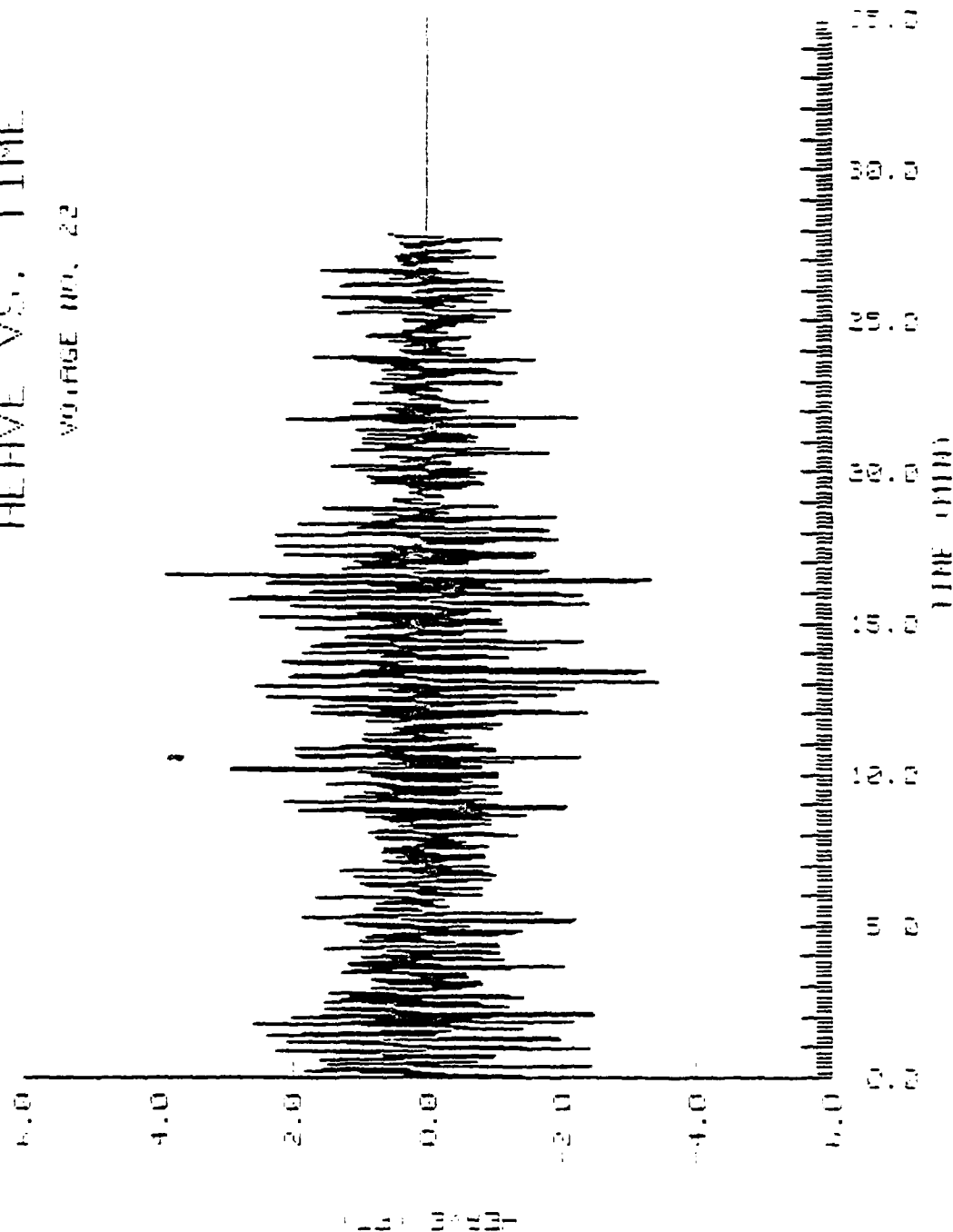


135. 135. 12 1005



# HEAVE VS. TIME

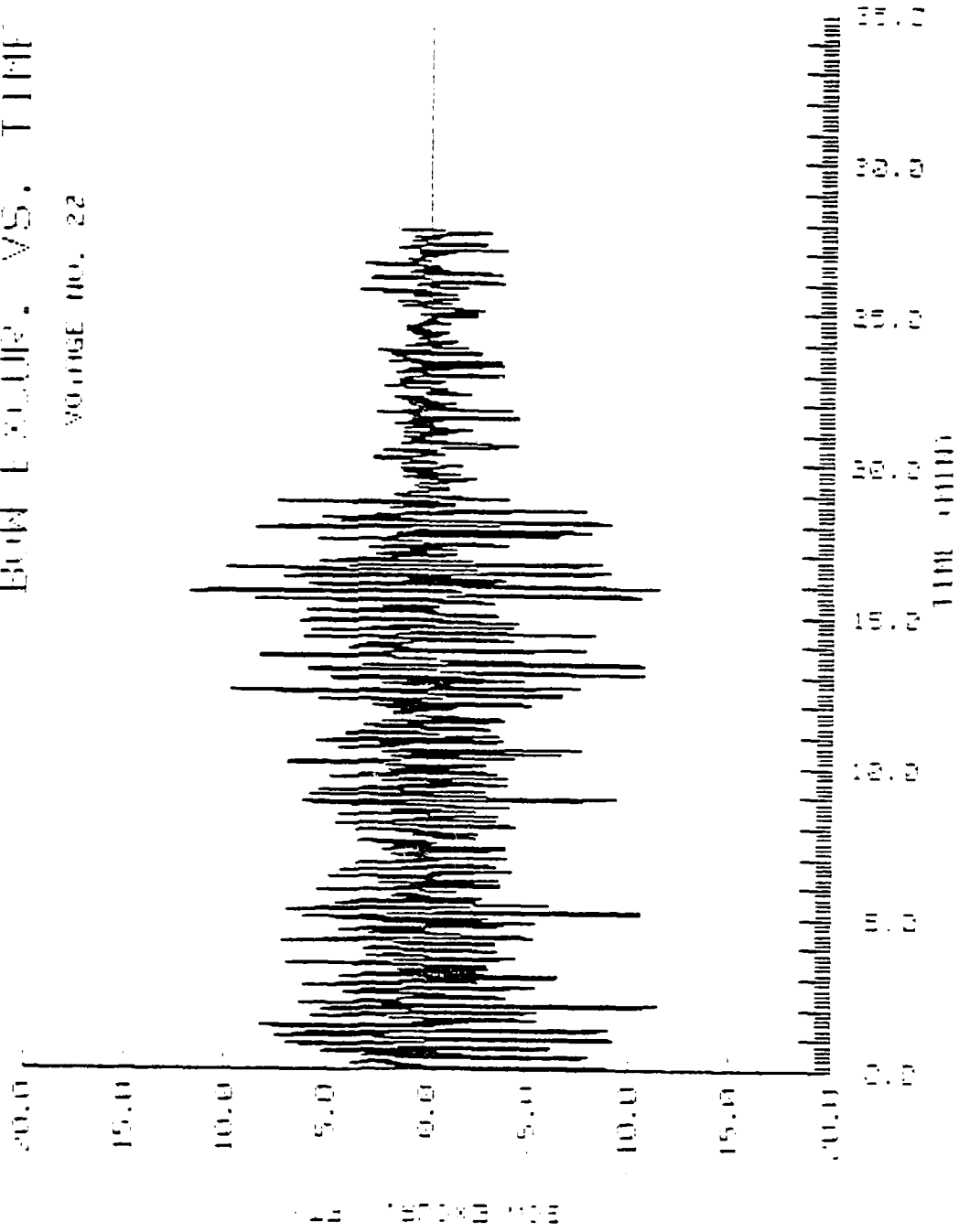
VOLUME NO. 22





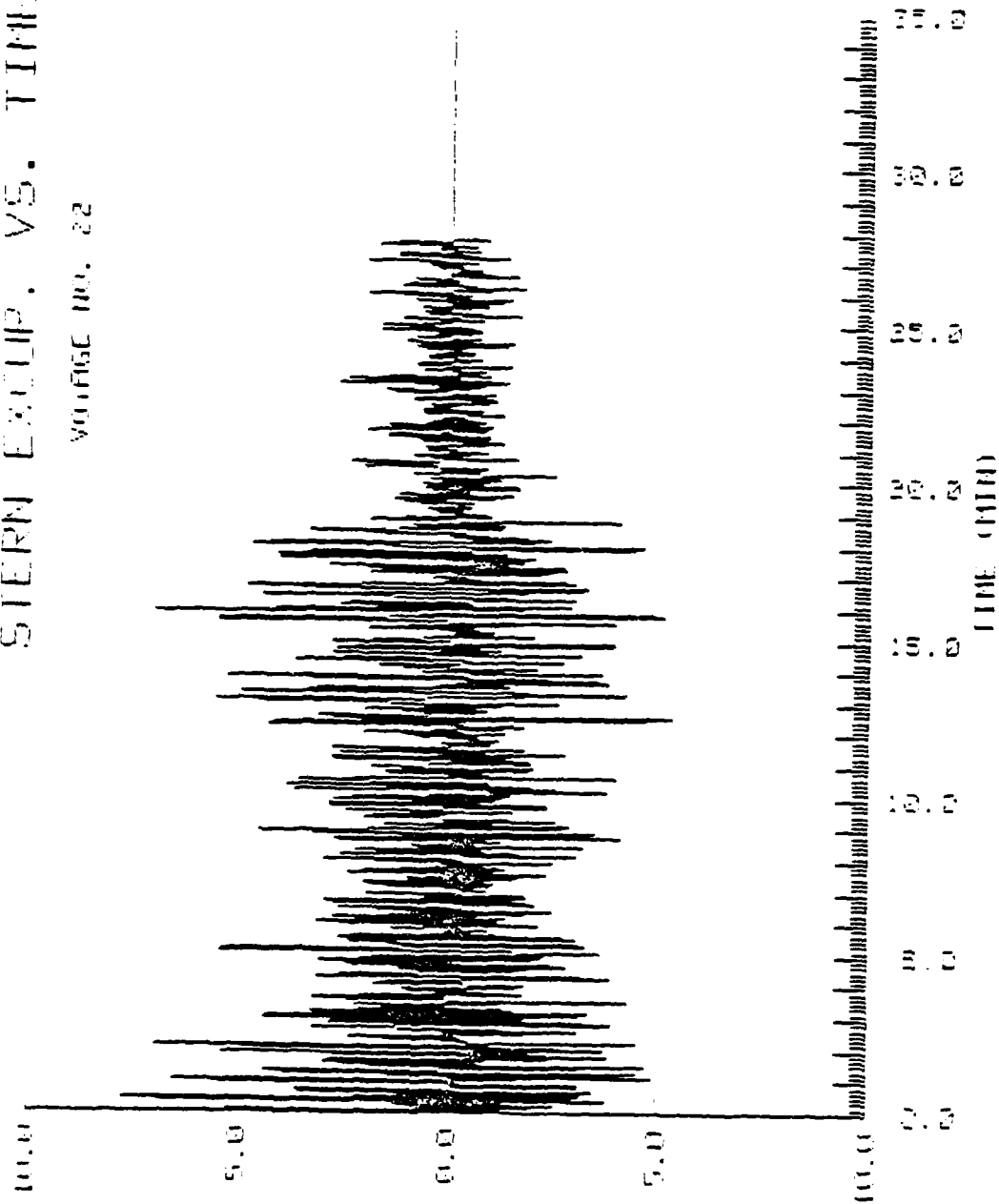
# BOW COLOR. VS. TIME

VOLUME NO. 22





# STERN EXCIP. VS. TIME VOLUME NO. 22

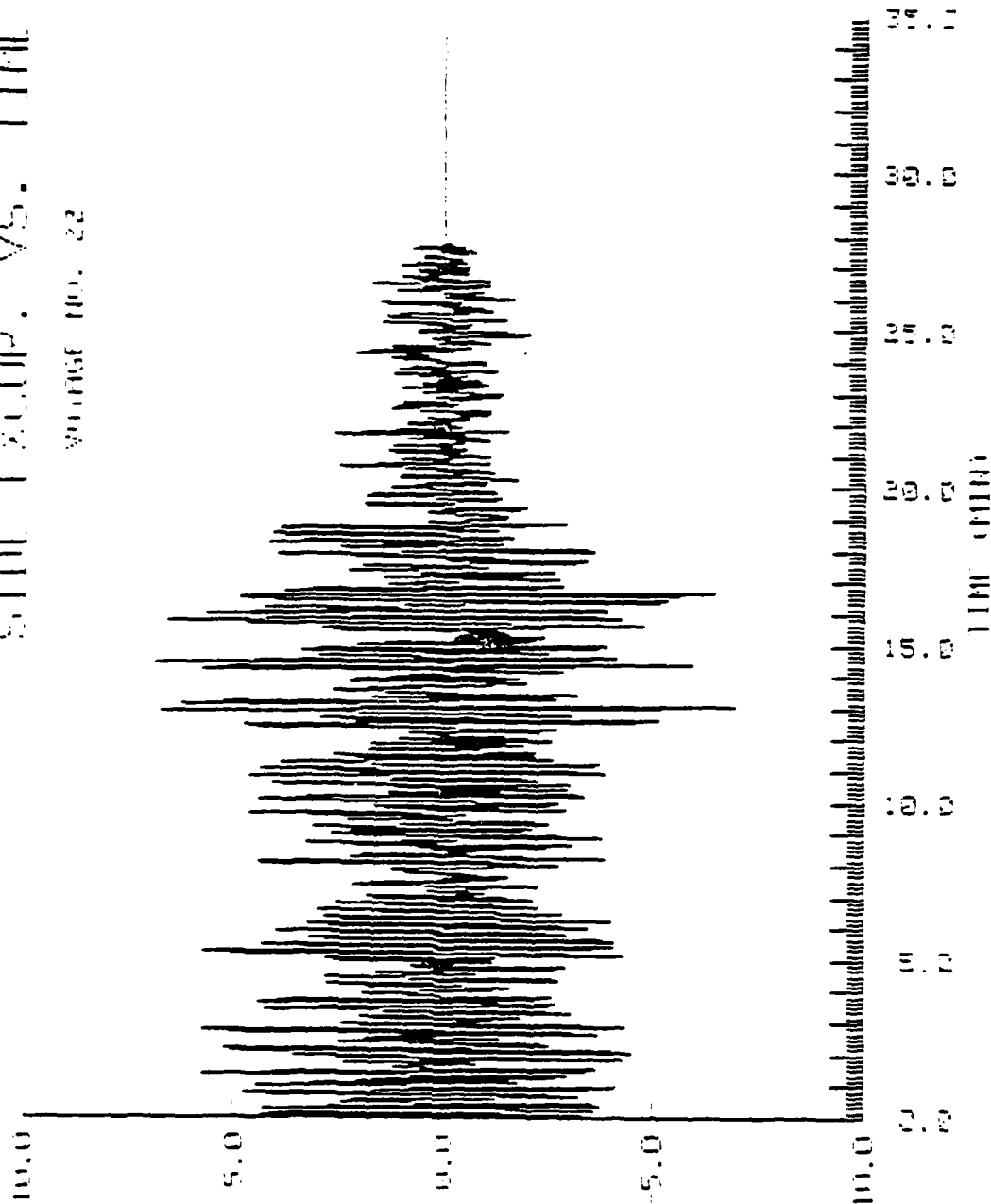


1971-1972



SILH GROUP VS. TIME

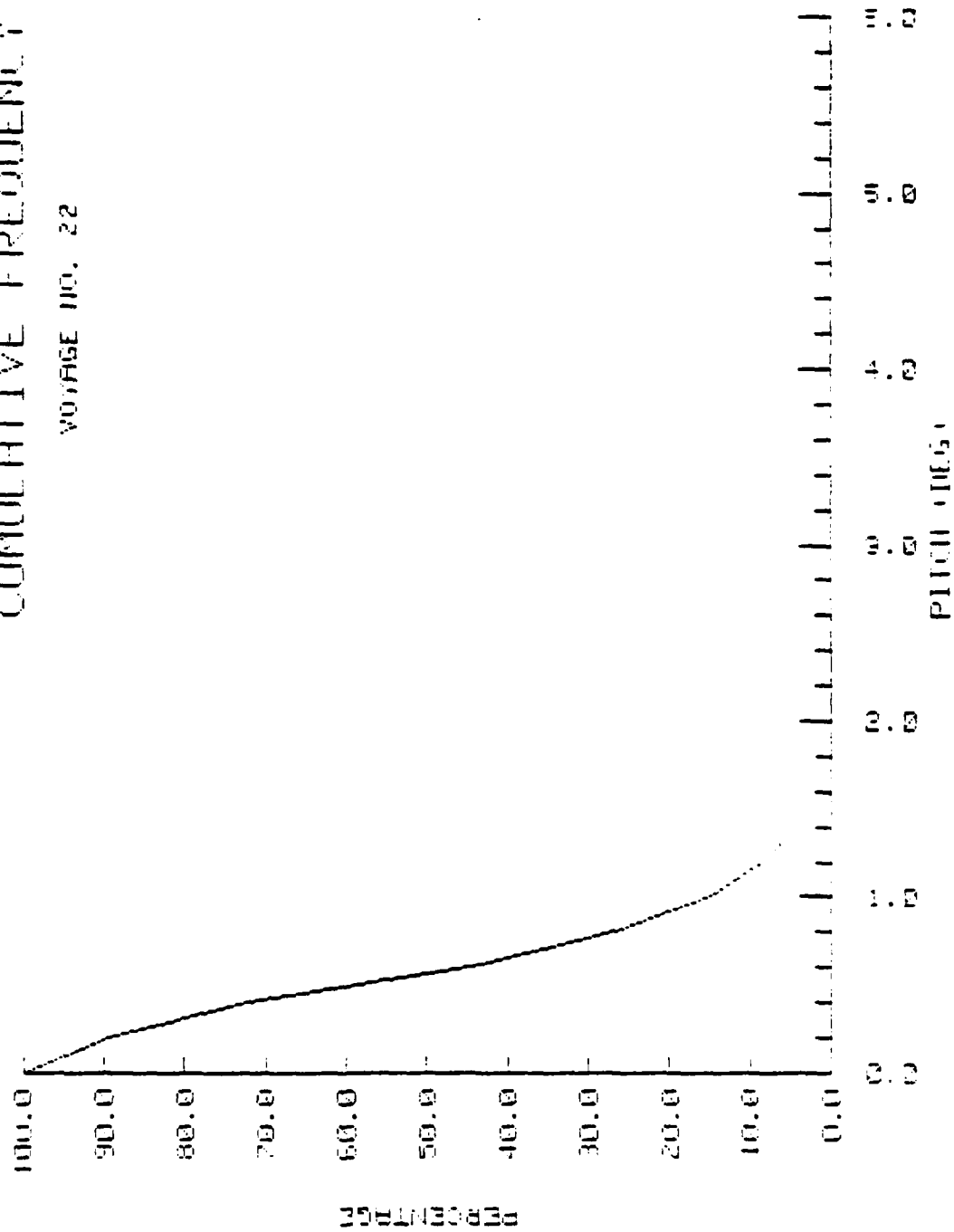
WINDS NO. 22





# CUMULATIVE FREQUENCY

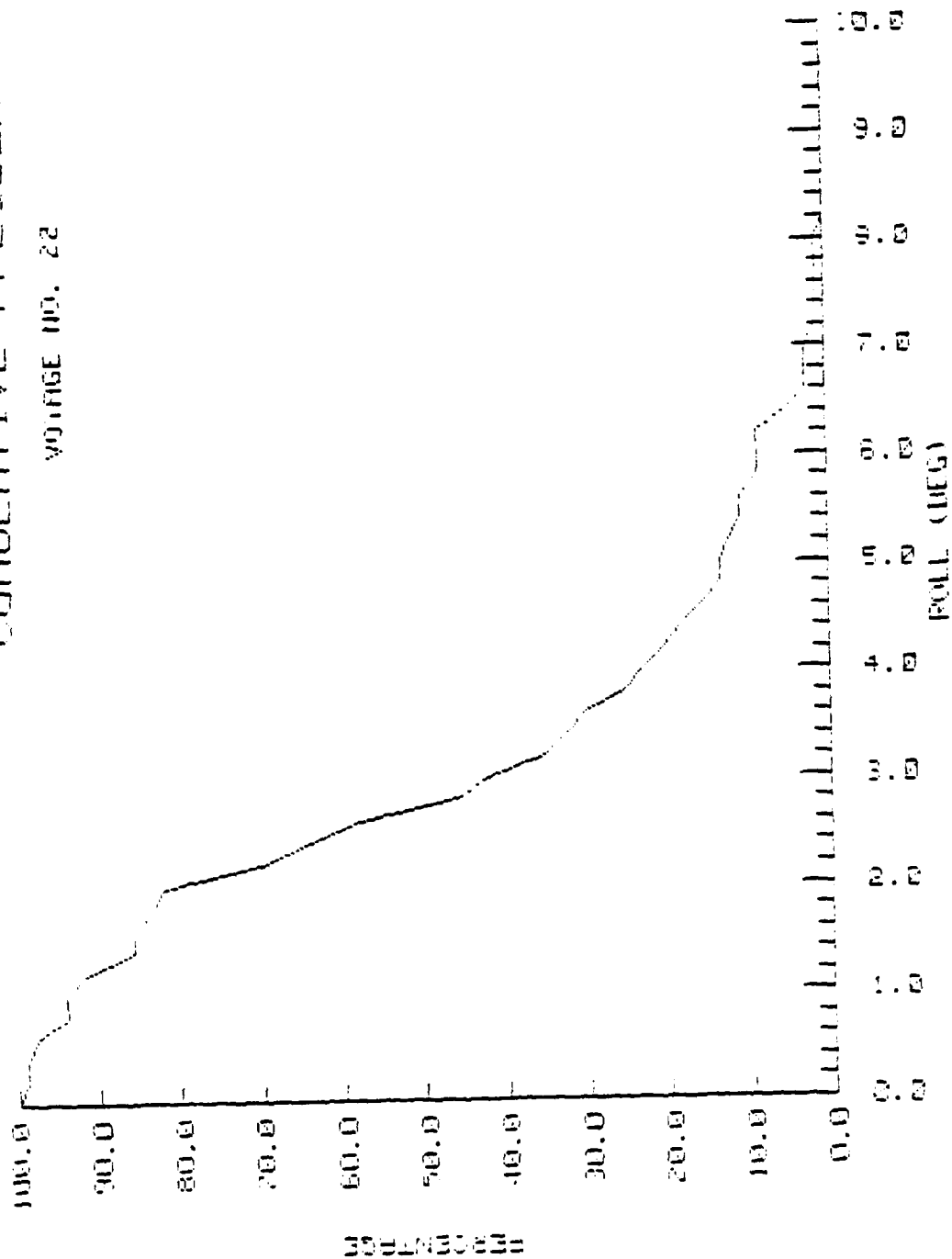
VOLAGE NO. 22





# CUMULATIVE FREQUENCY

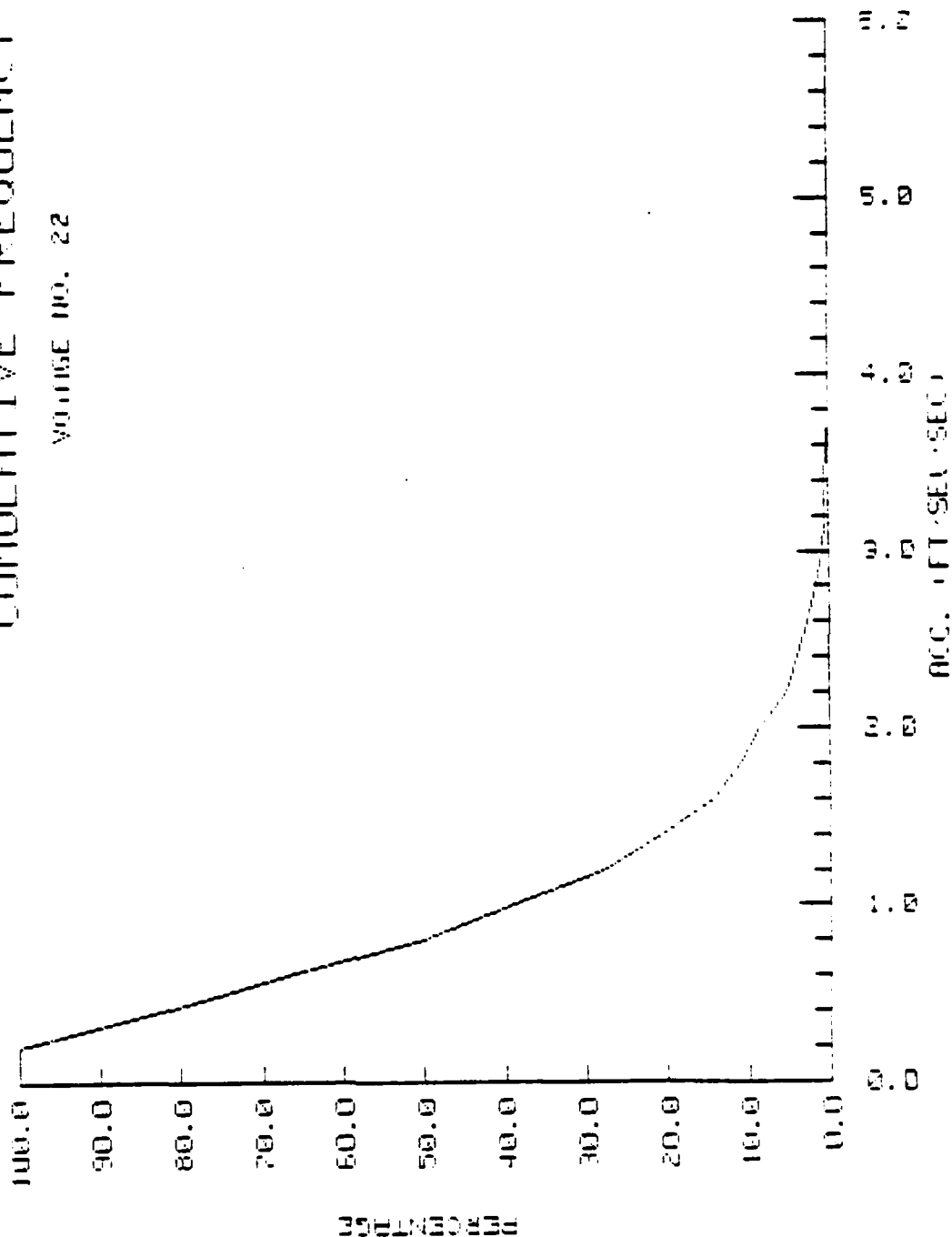
VOLUME NO. 22





# CUMULATIVE FREQUENCY

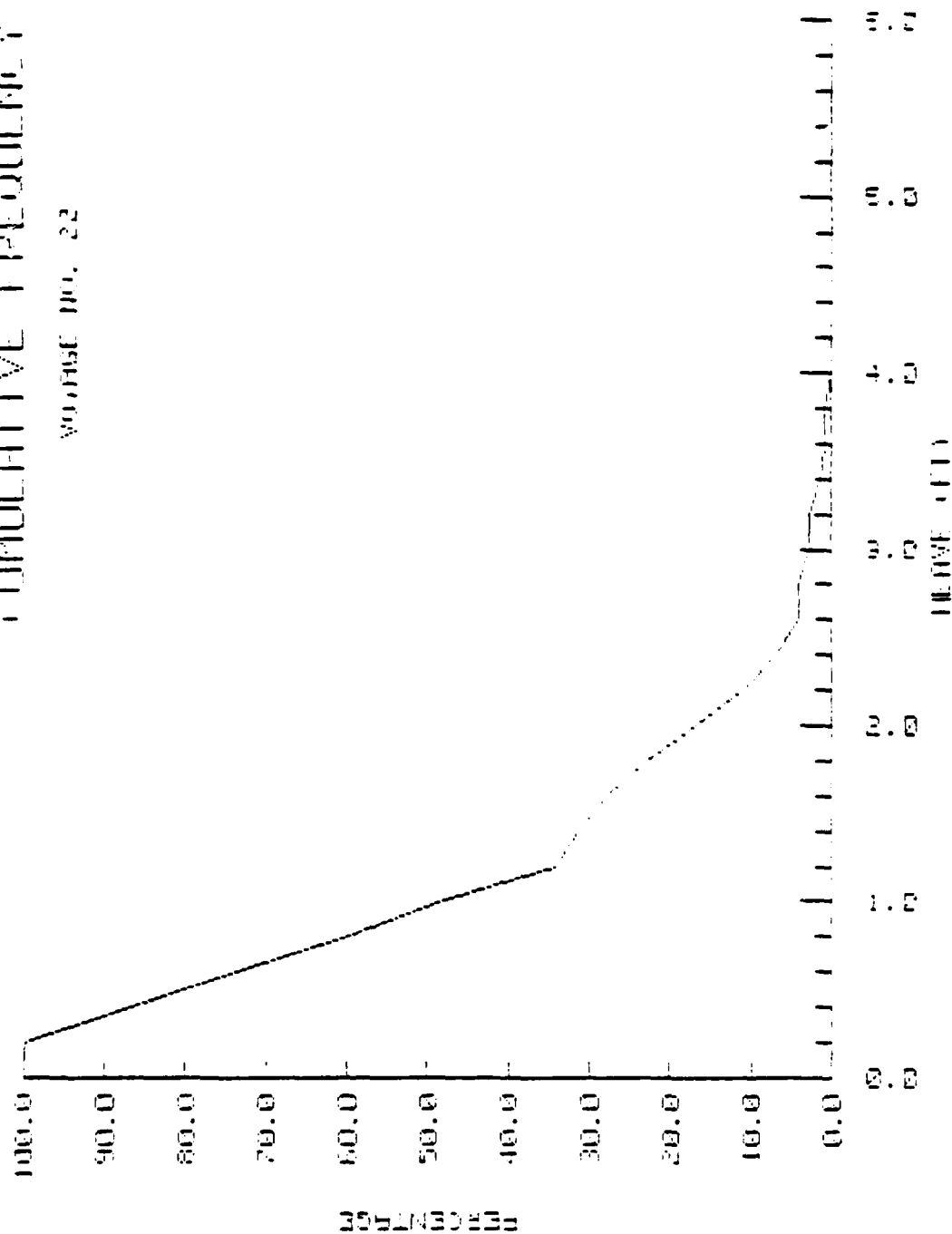
VOLUME NO. 22





# CUMULATIVE FREQUENCY

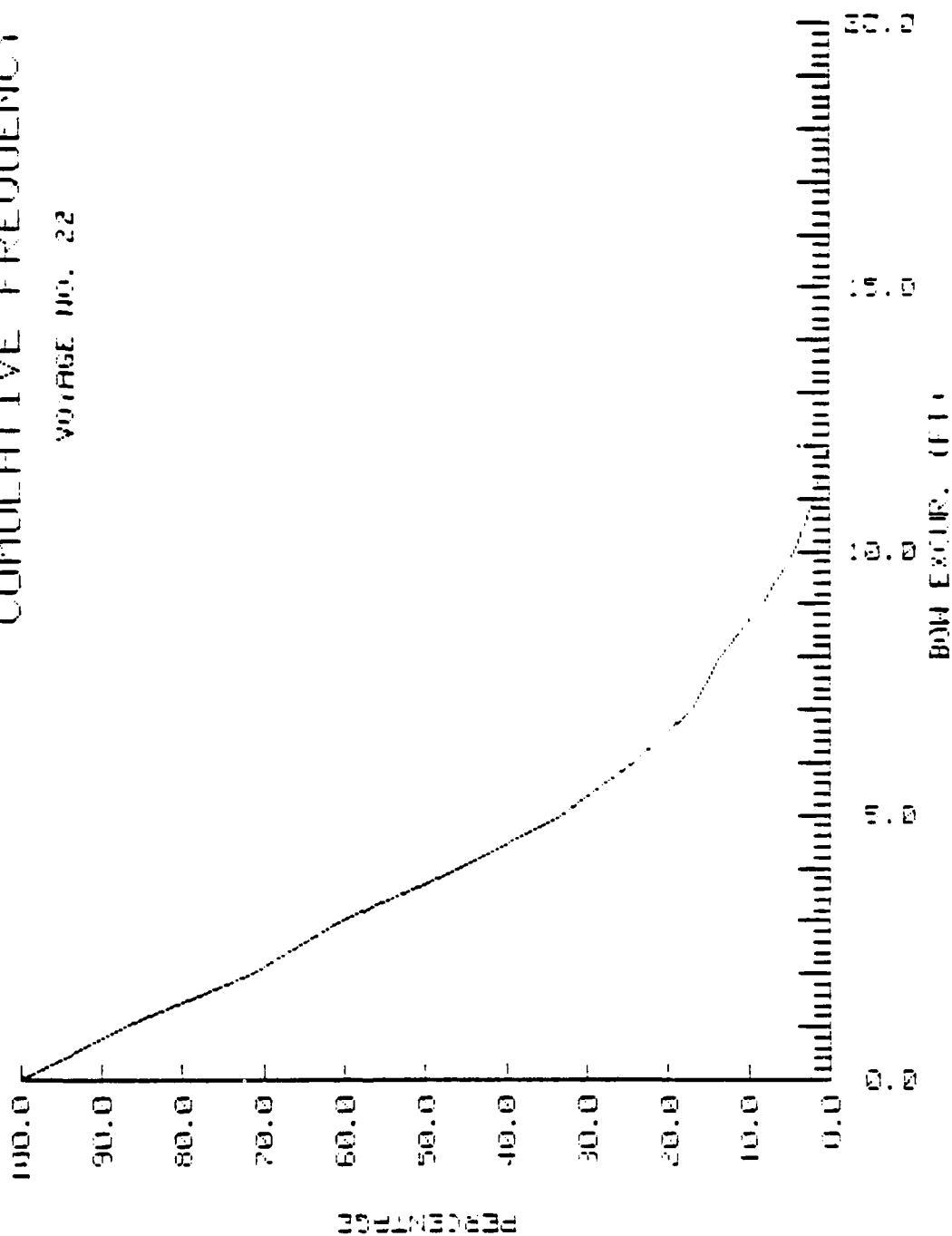
W0056E 100, 22





# CUMULATIVE FREQUENCY

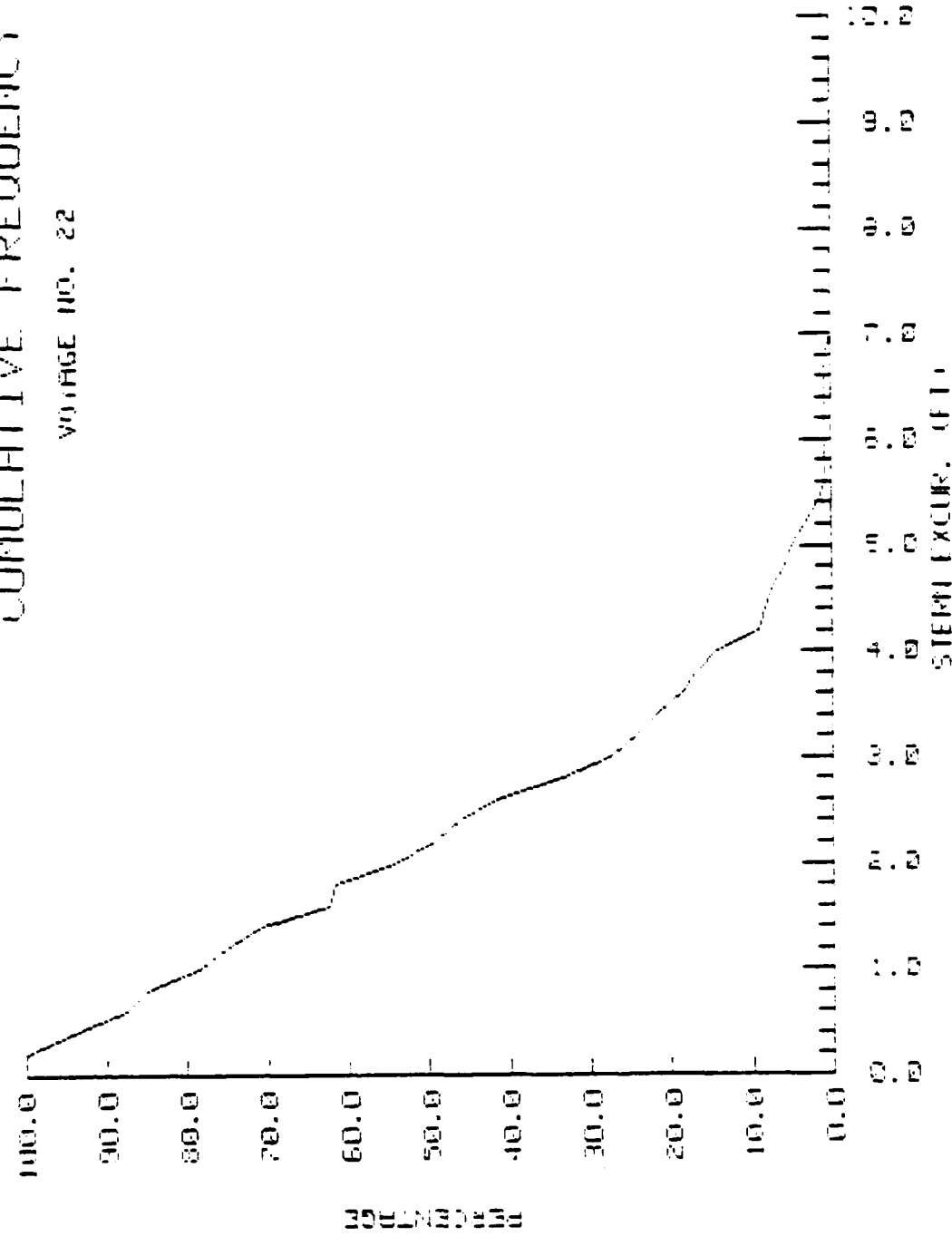
VOLUME NO. 22





# CUMULATIVE FREQUENCY

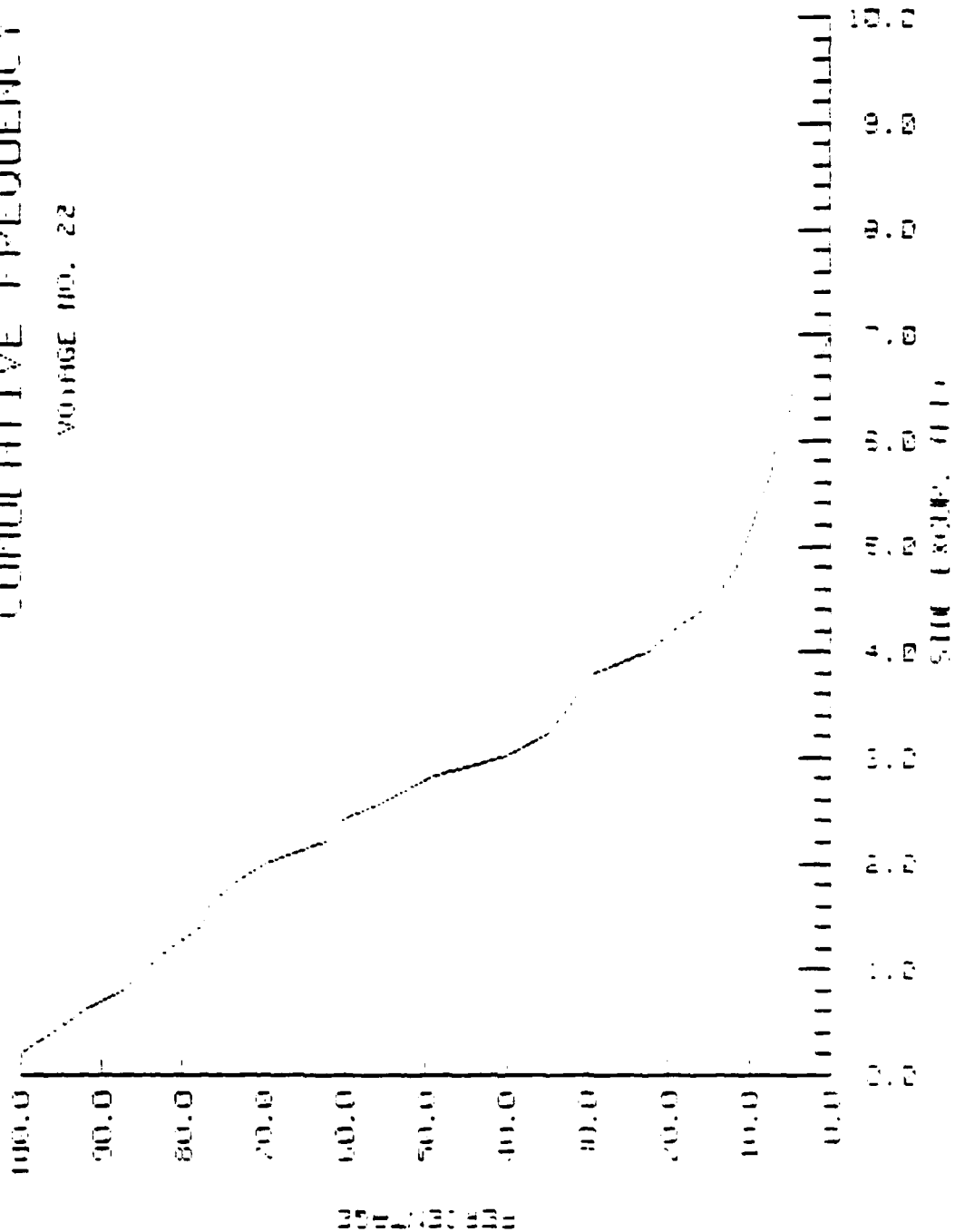
PAGE NO. 22





# CUMULATIVE FREQUENCY

VOLUME NO. 22





# STATISTICAL SUMMARY

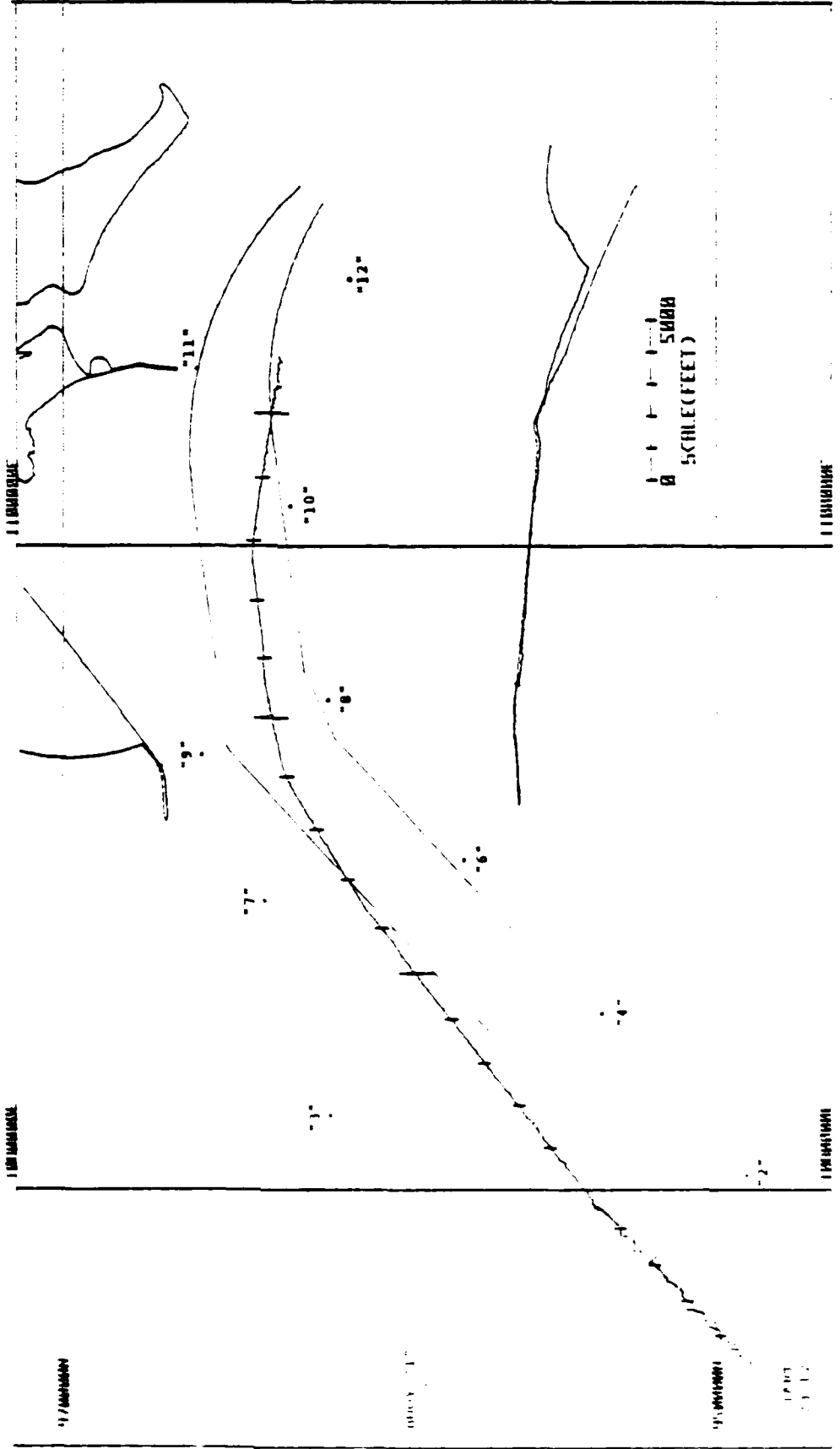
VOLUME NO. 23

	MEAN VALUE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
1. 1000 - 1000	.5	1.1	.4	.5
2. 1000 - 1000	.0	9.6	1.7	1.9
3. 1000 - 1000	.0	4.9	.5	.7
4. 1000 - 1000	.0	2.4	.9	1.0
5. 1000 - 1000	.0	8.2	2.9	3.4
6. 1000 - 1000	.0	4.5	1.7	1.9
7. 1000 - 1000	.0	6.0	1.8	2.2



# VIEWED NW 24 SHEET TRICK

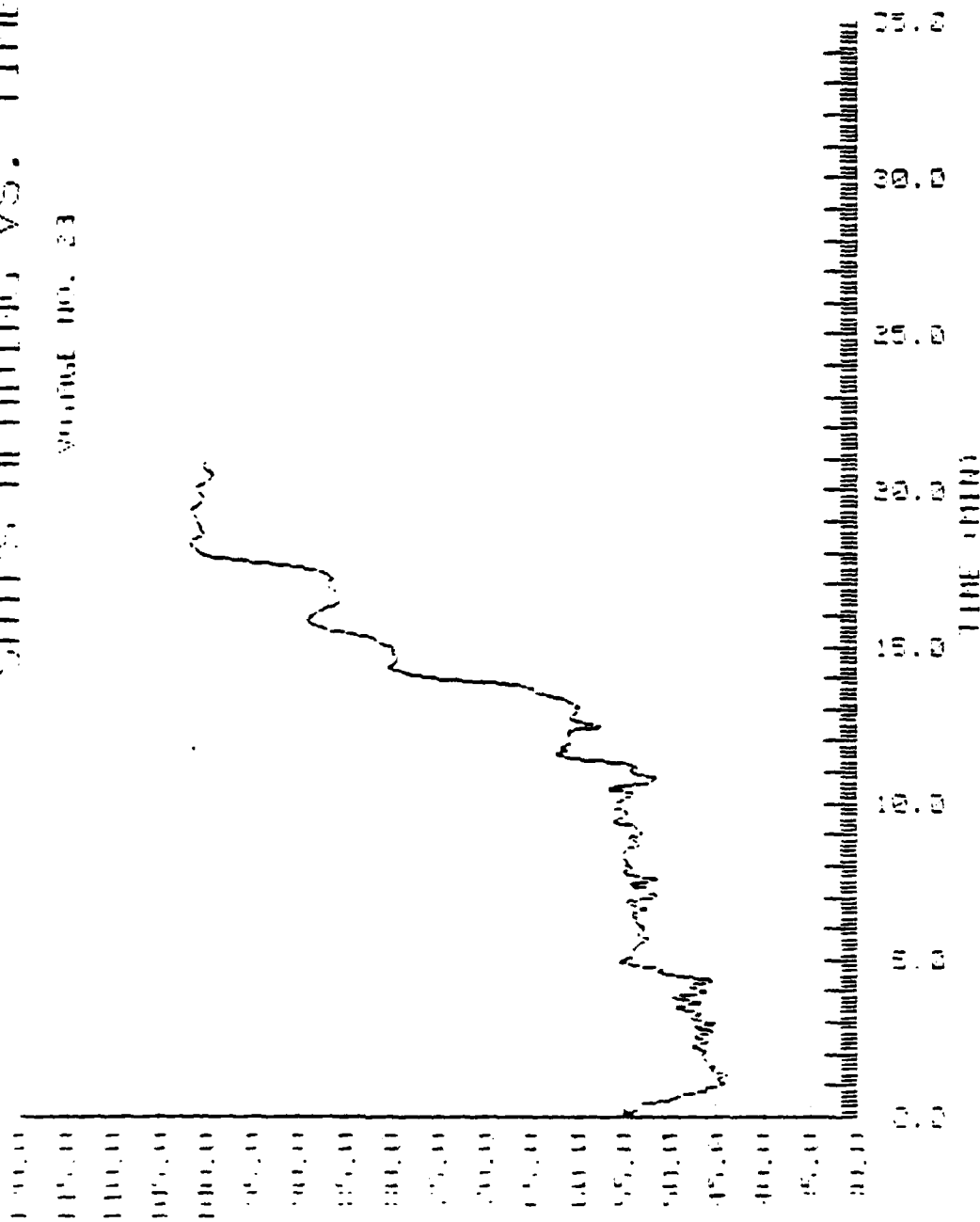
Scale 1:10000





# SOILS HUMIDITY VS. TIME

WINDTUN NO. 23

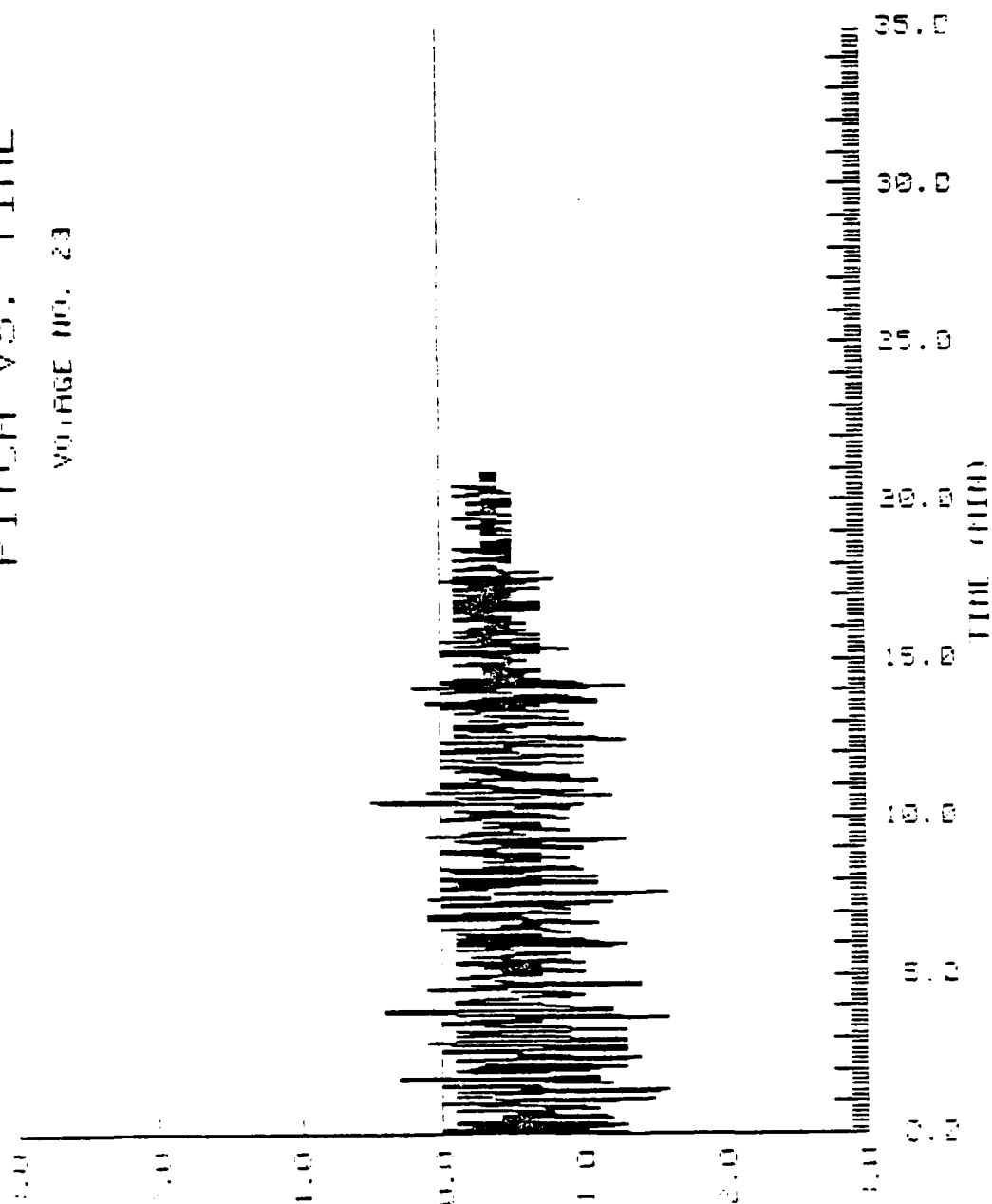


1.00 0.95 0.90 0.85 0.80 0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25 0.20 0.15 0.10 0.05 0.00



# PITCH VS. TIME

VOLUME NO. 23

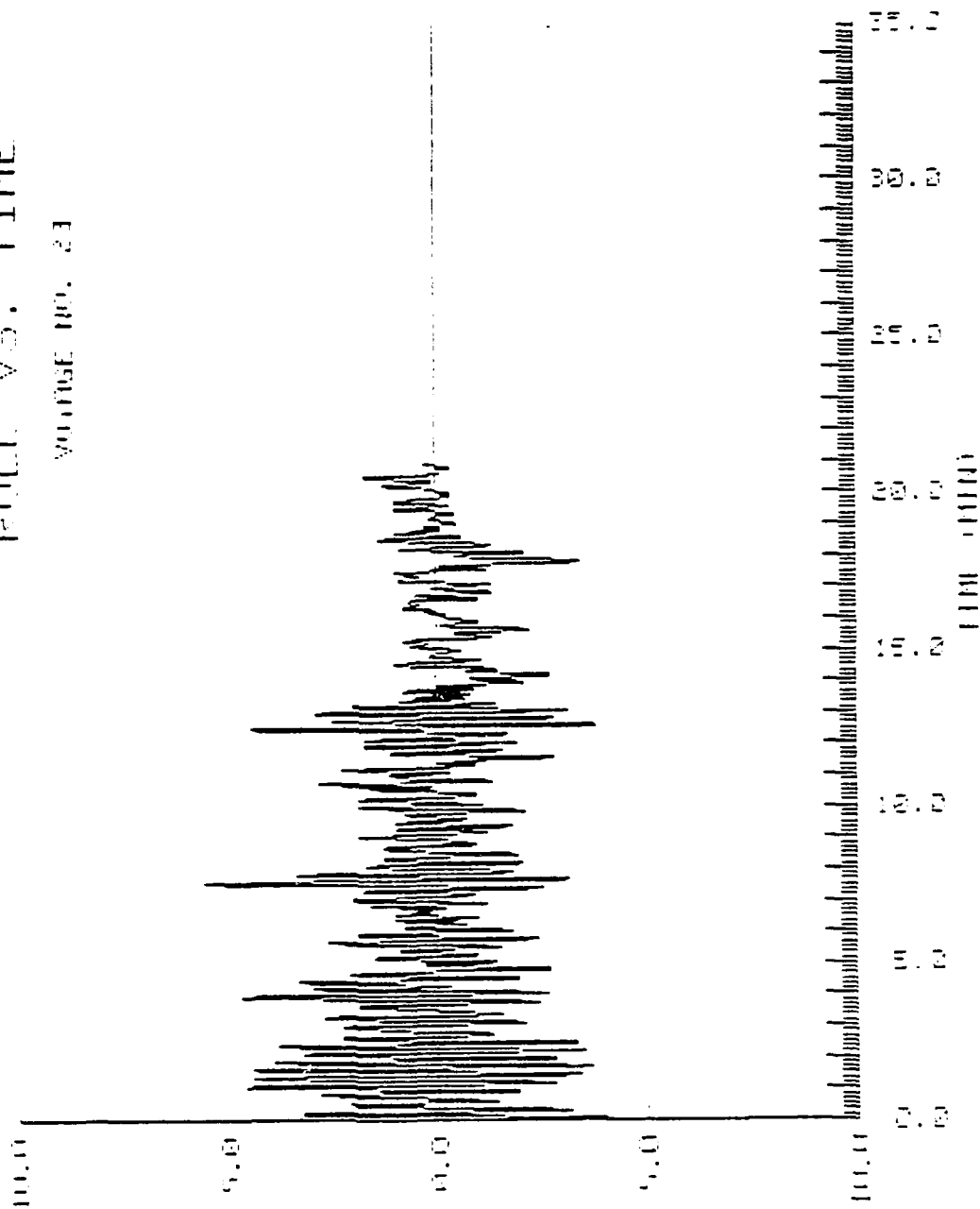


231 1111



# ROLL VS. TIME

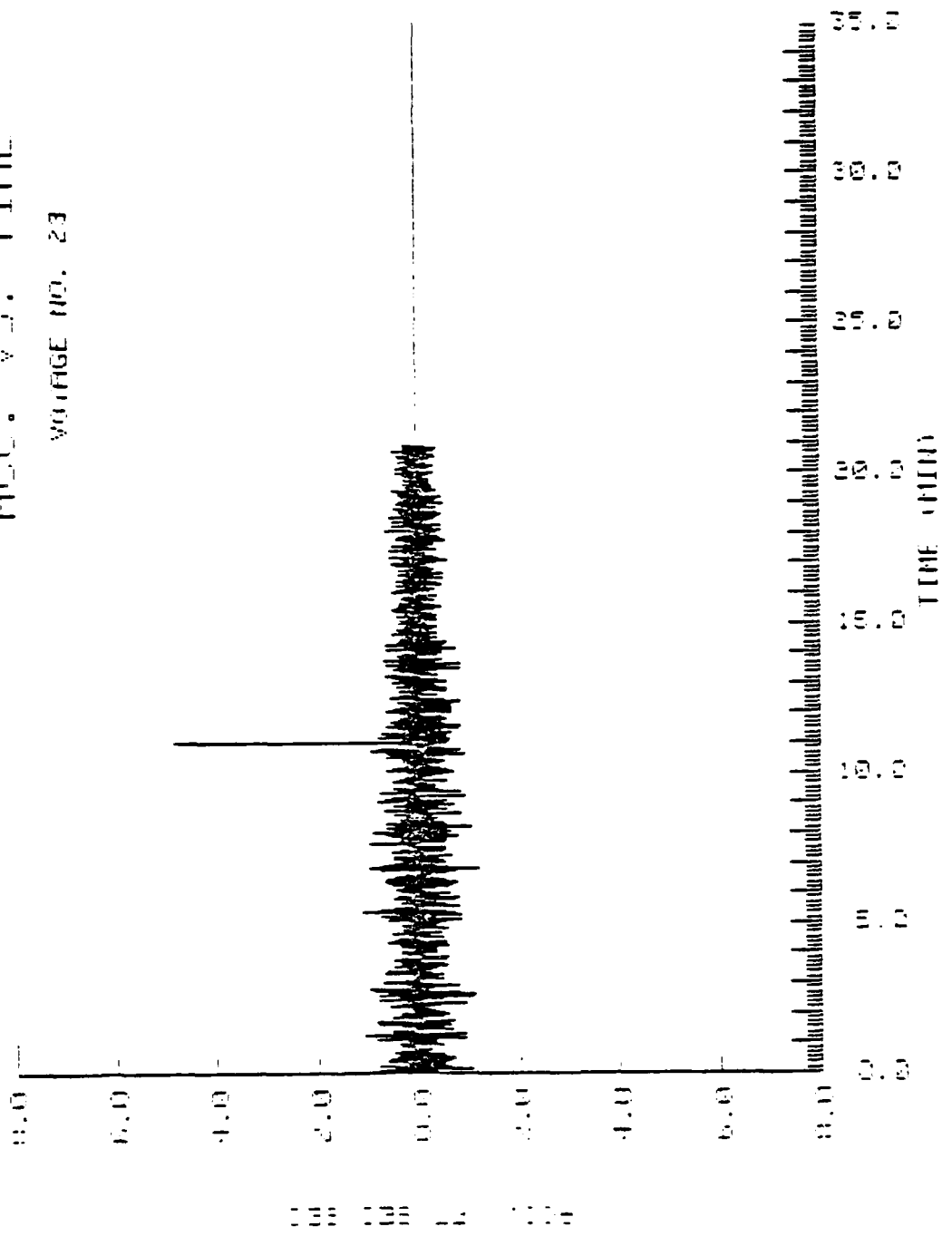
VOYAGE NO. 23





# FIG. VS. TIME

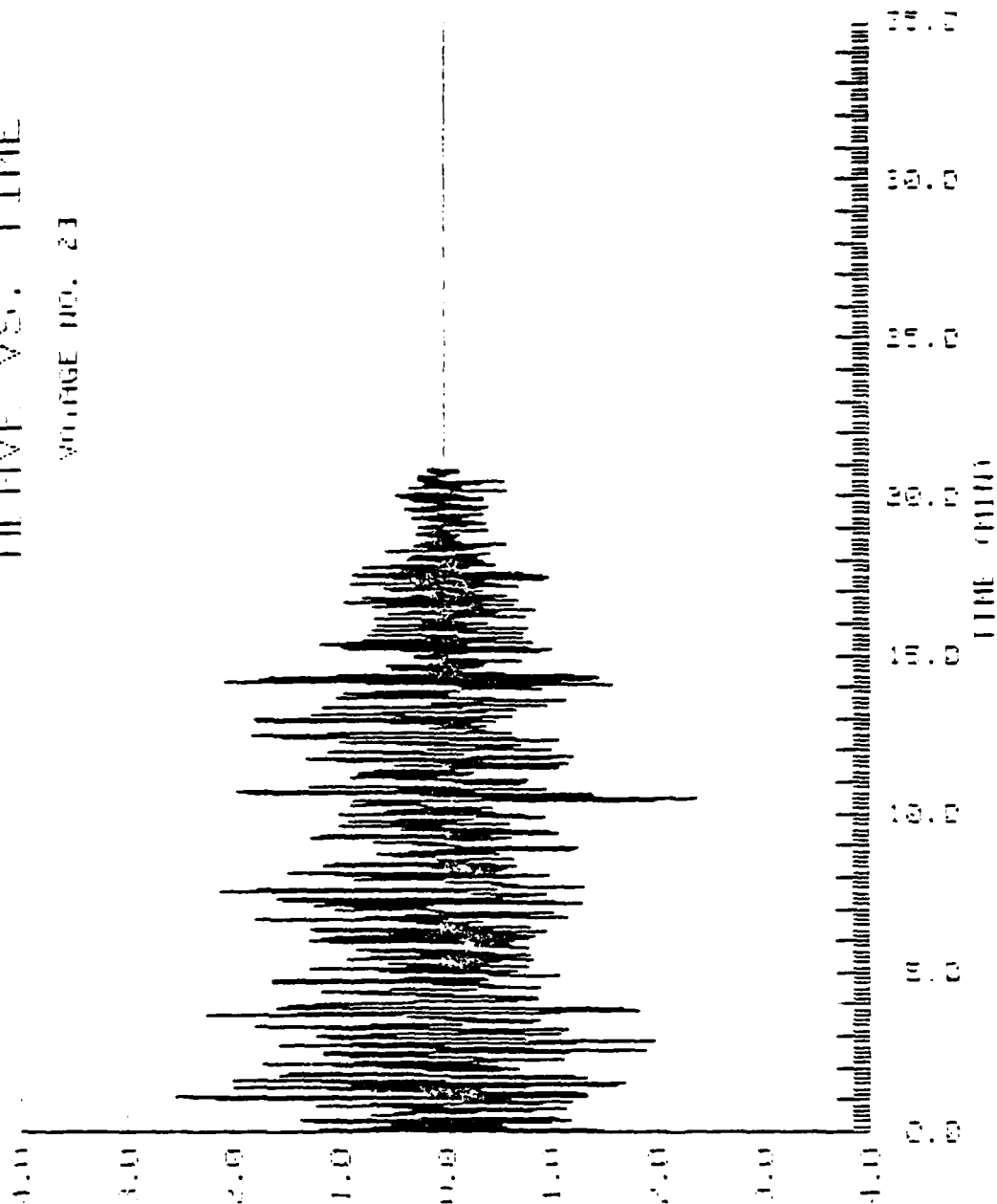
VOLUME NO. 23





# IMPULSE VS. TIME

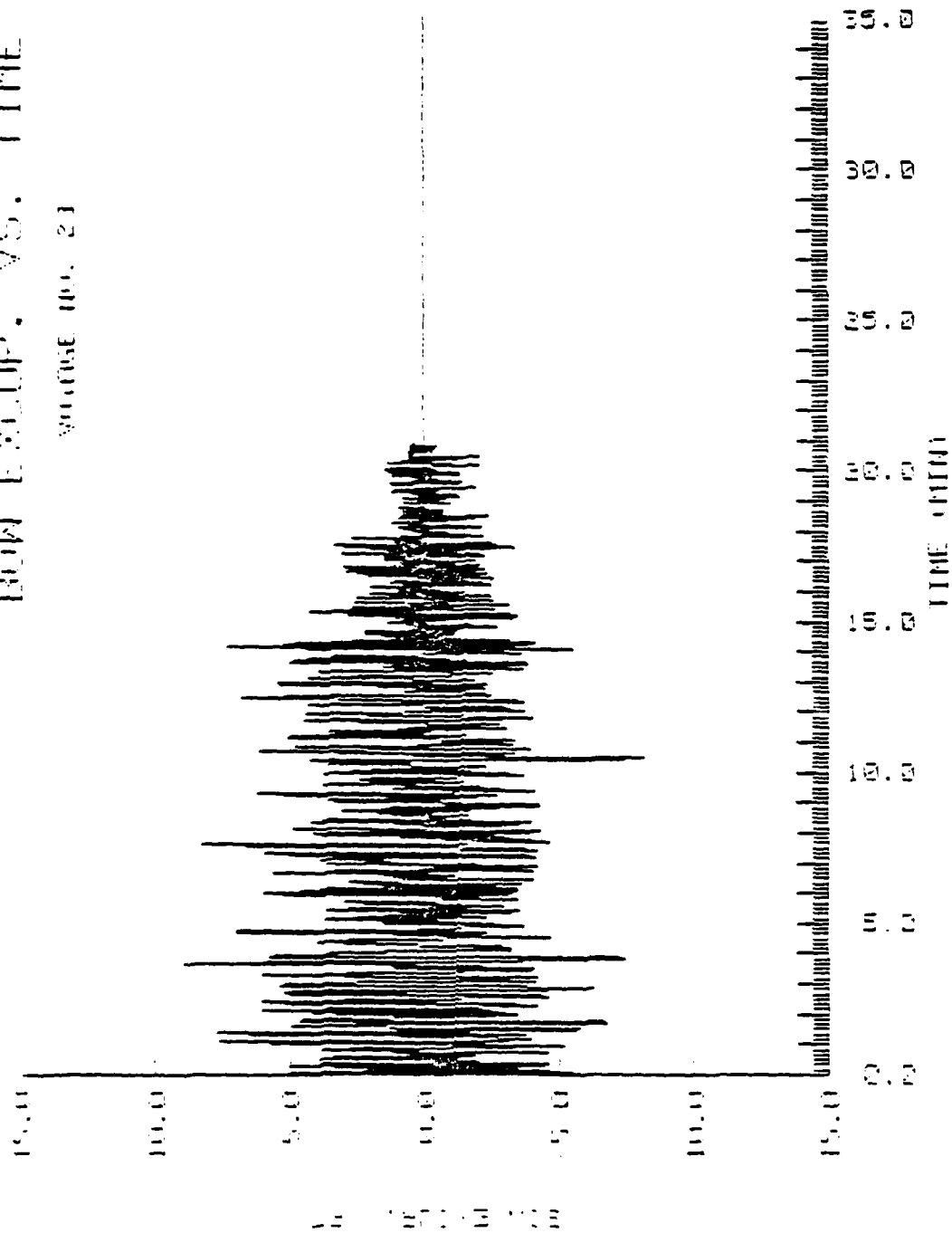
VOLUME NO. 23



11 37134



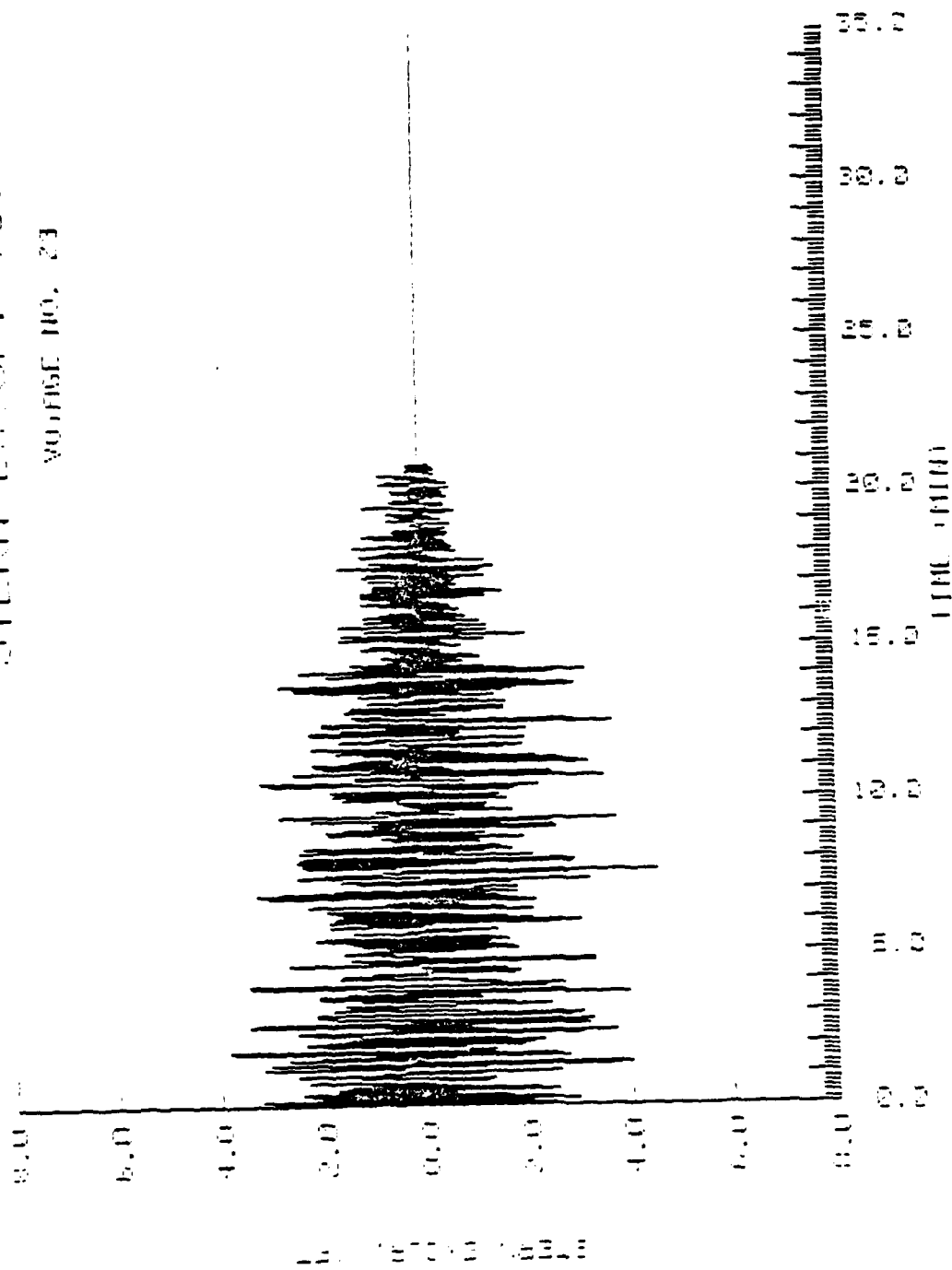
# LOW ECLIP. VS. TIME W000500.21





# STERN EXTUP. VS. TIME

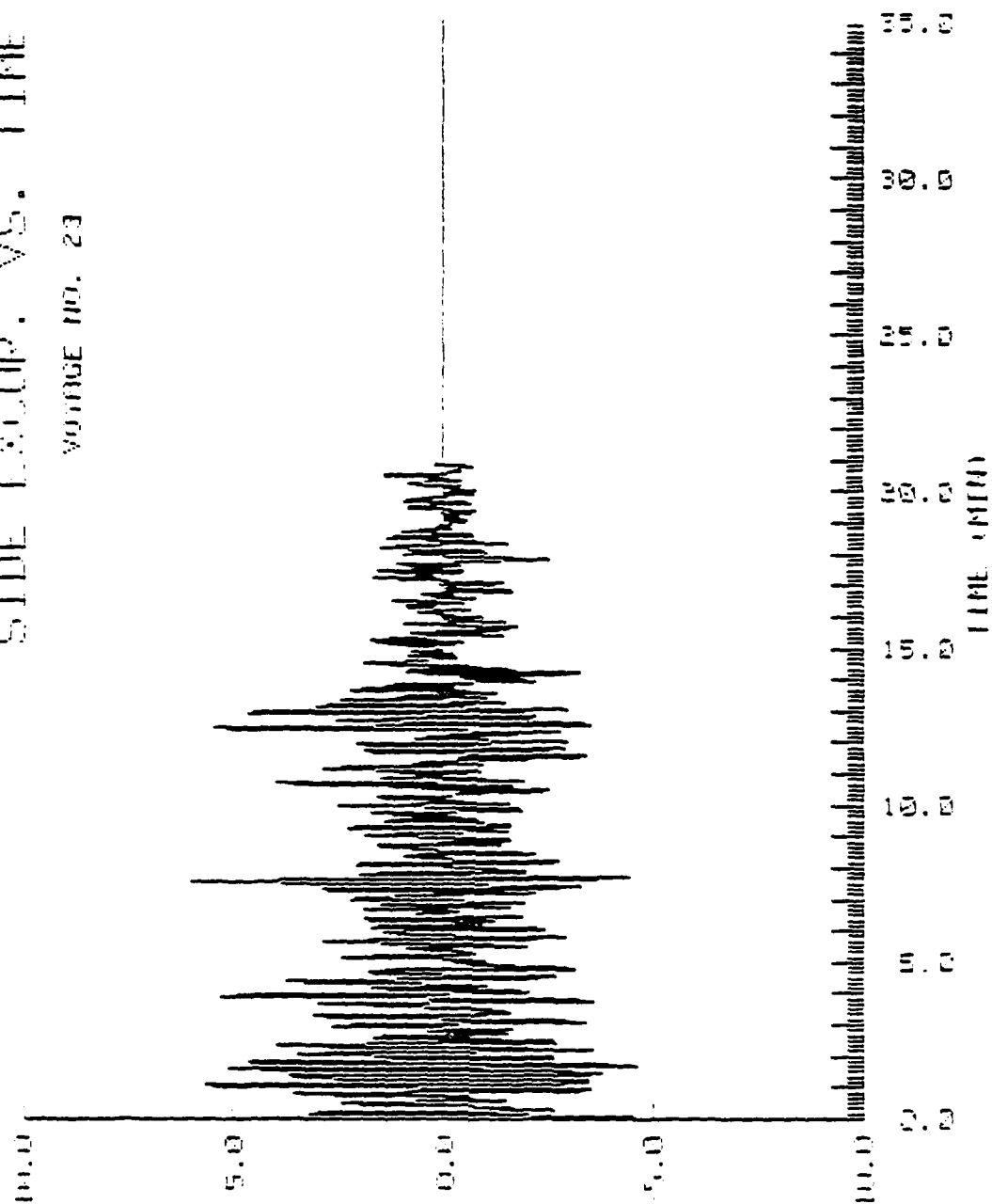
VOYAGE NO. 23





# SUE LAPOINTE VS. THE

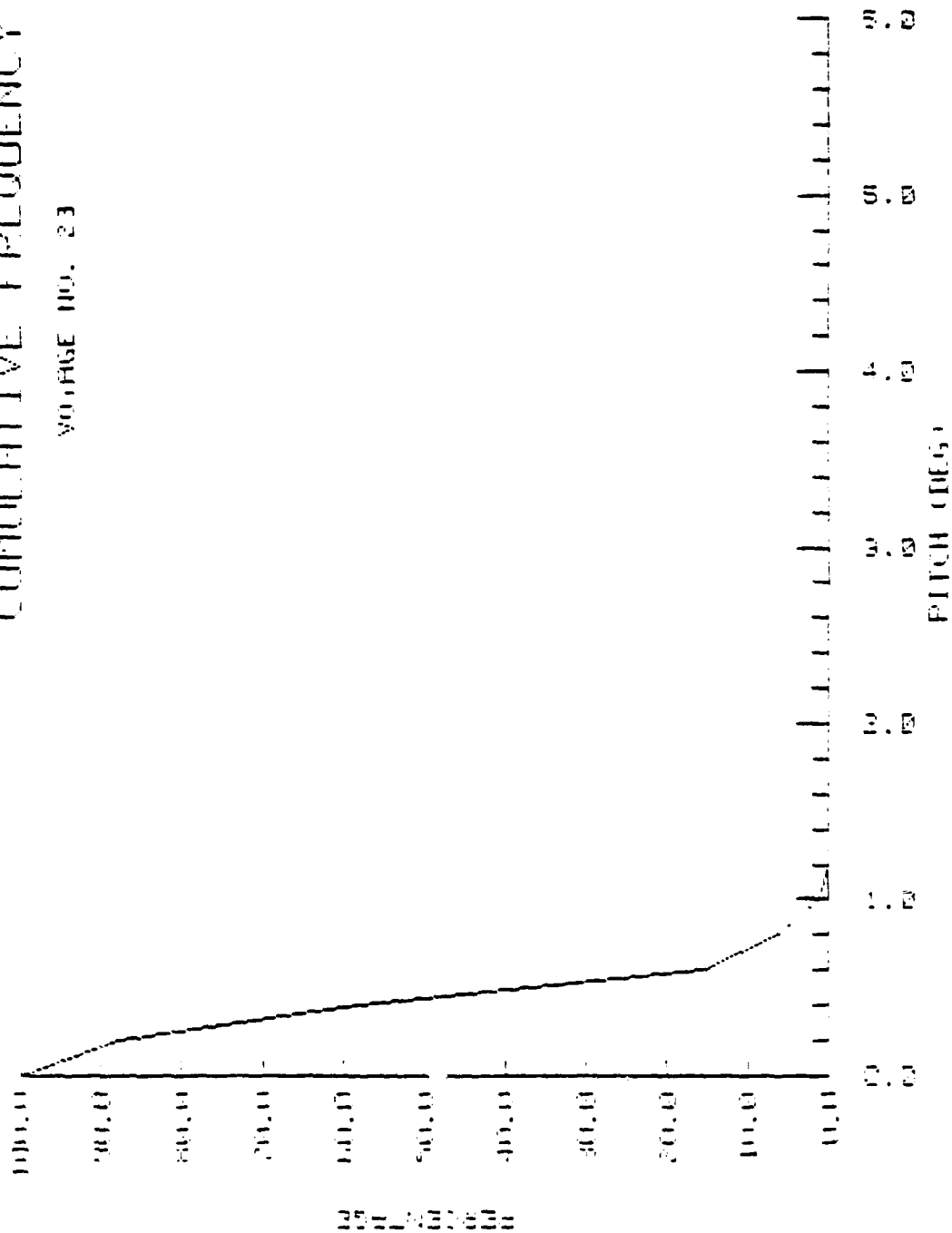
VOIRGE 107. 23





# CUMULATIVE FREQUENCY

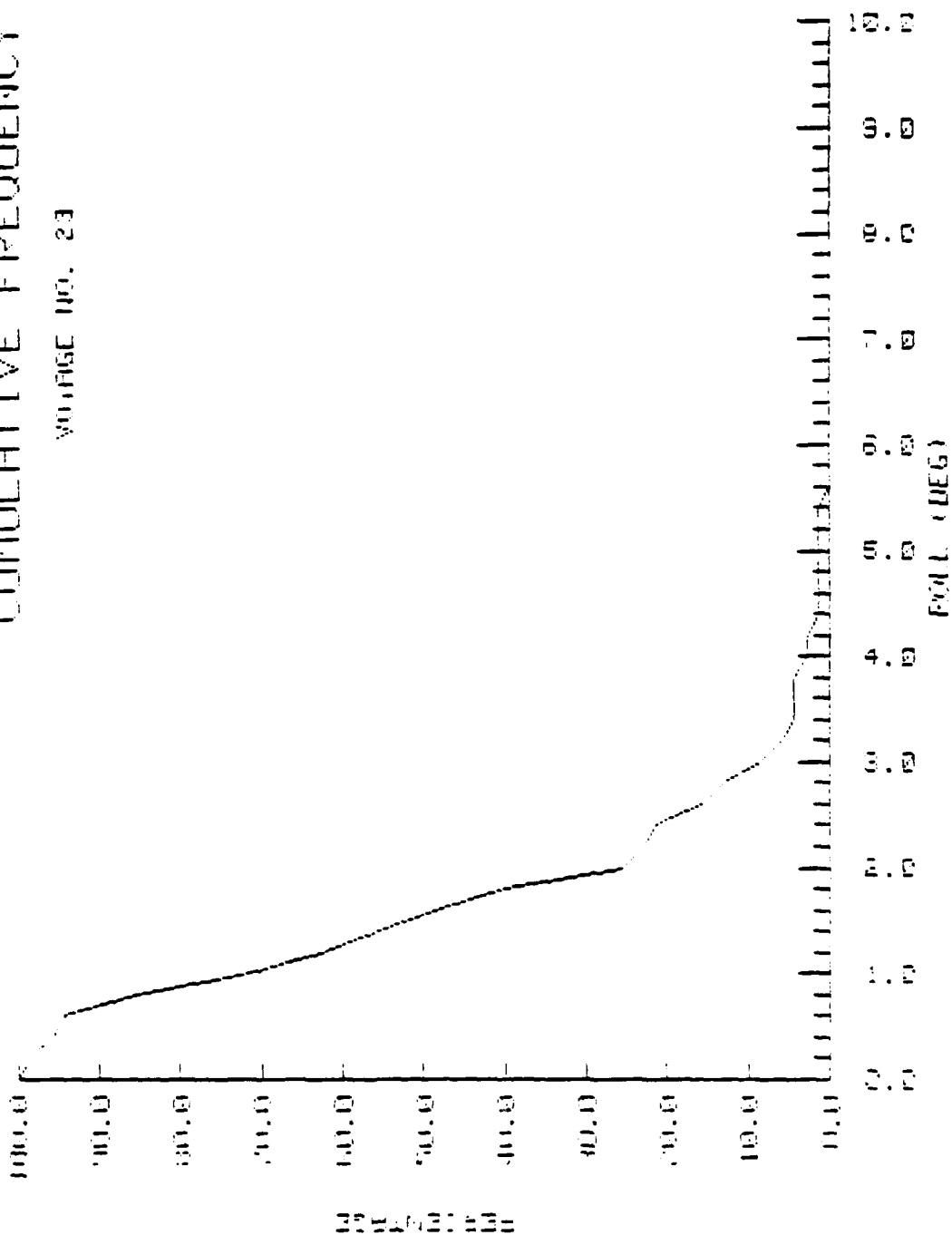
W0, AGE 110, 23





# CUMULATIVE FREQUENCY

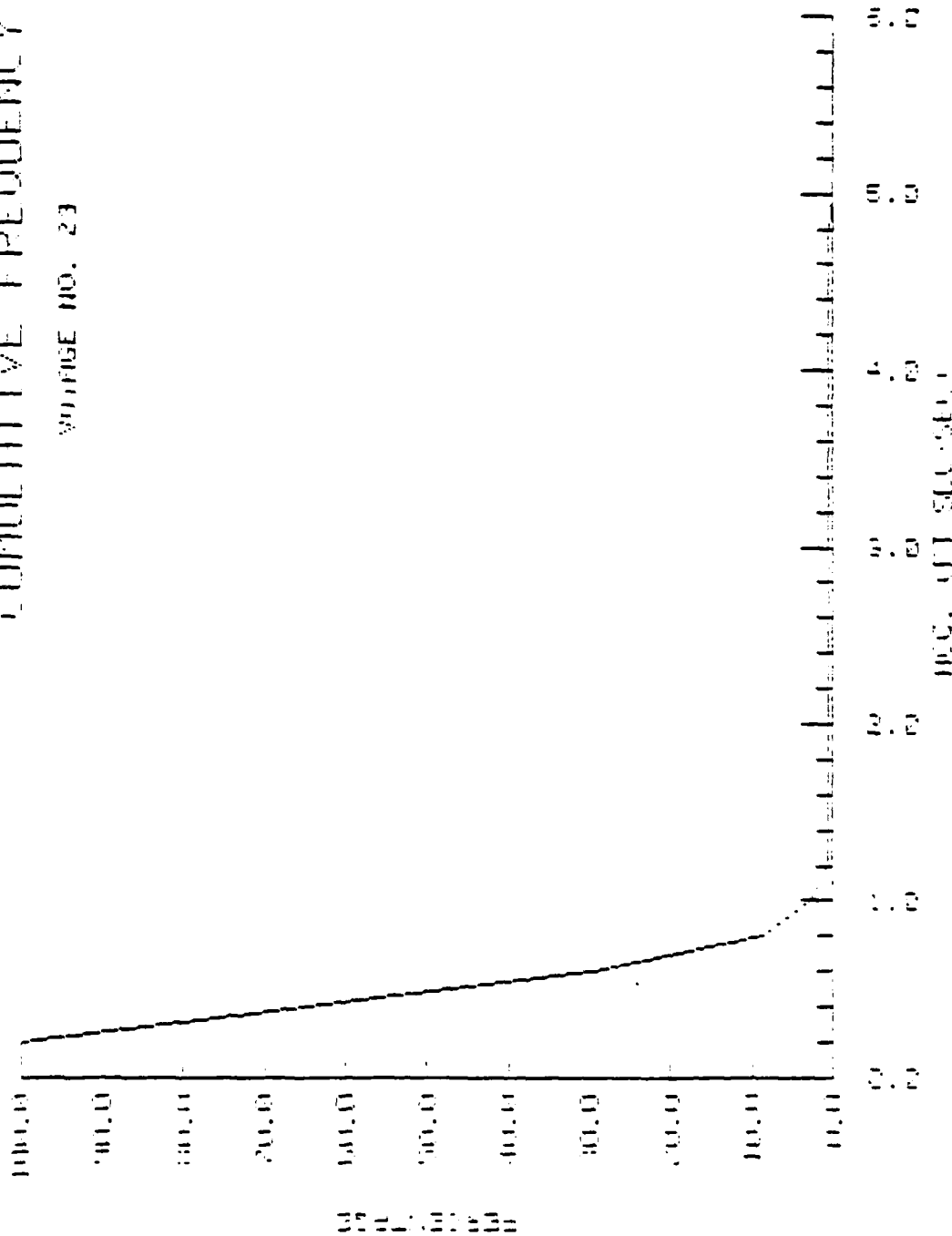
VOLUME NO. 23





# CUMULATIVE FREQUENCY

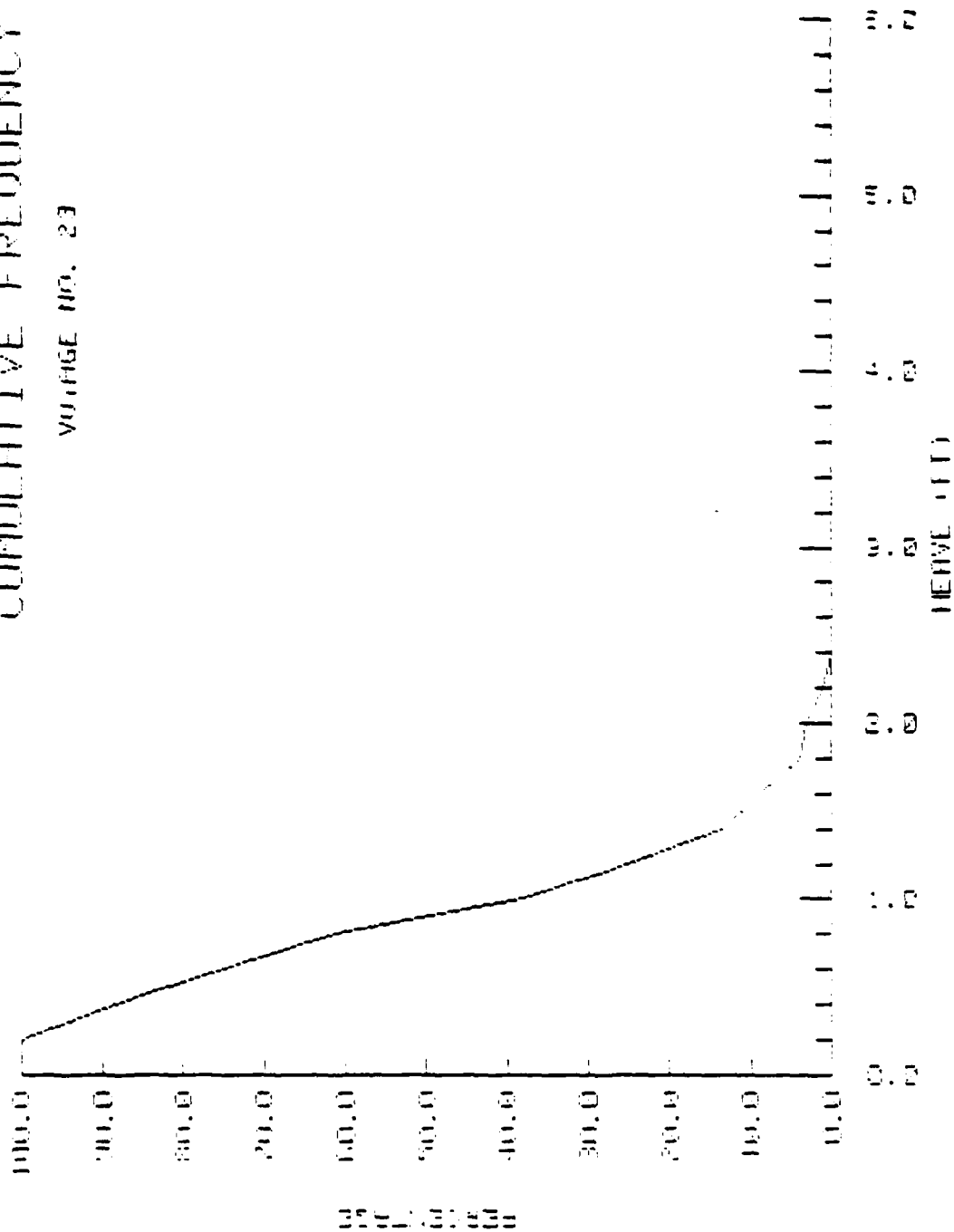
VOLUME NO. 23





# CUMULATIVE FREQUENCY

VOLUME NO. 23





# CUMULATIVE FREQUENCY

VOYAGE NO. 23

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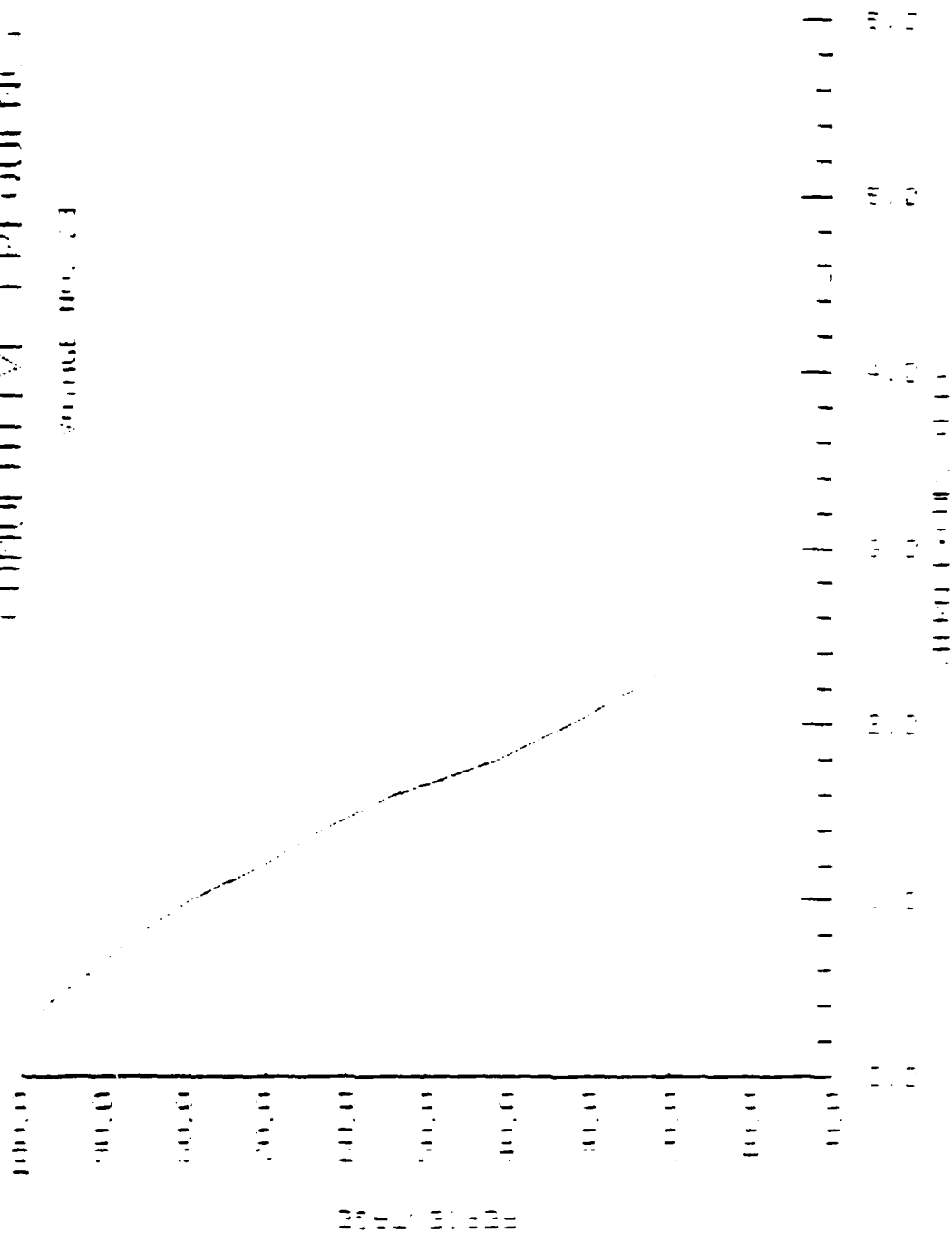
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BOAT EXCURSION, 1911

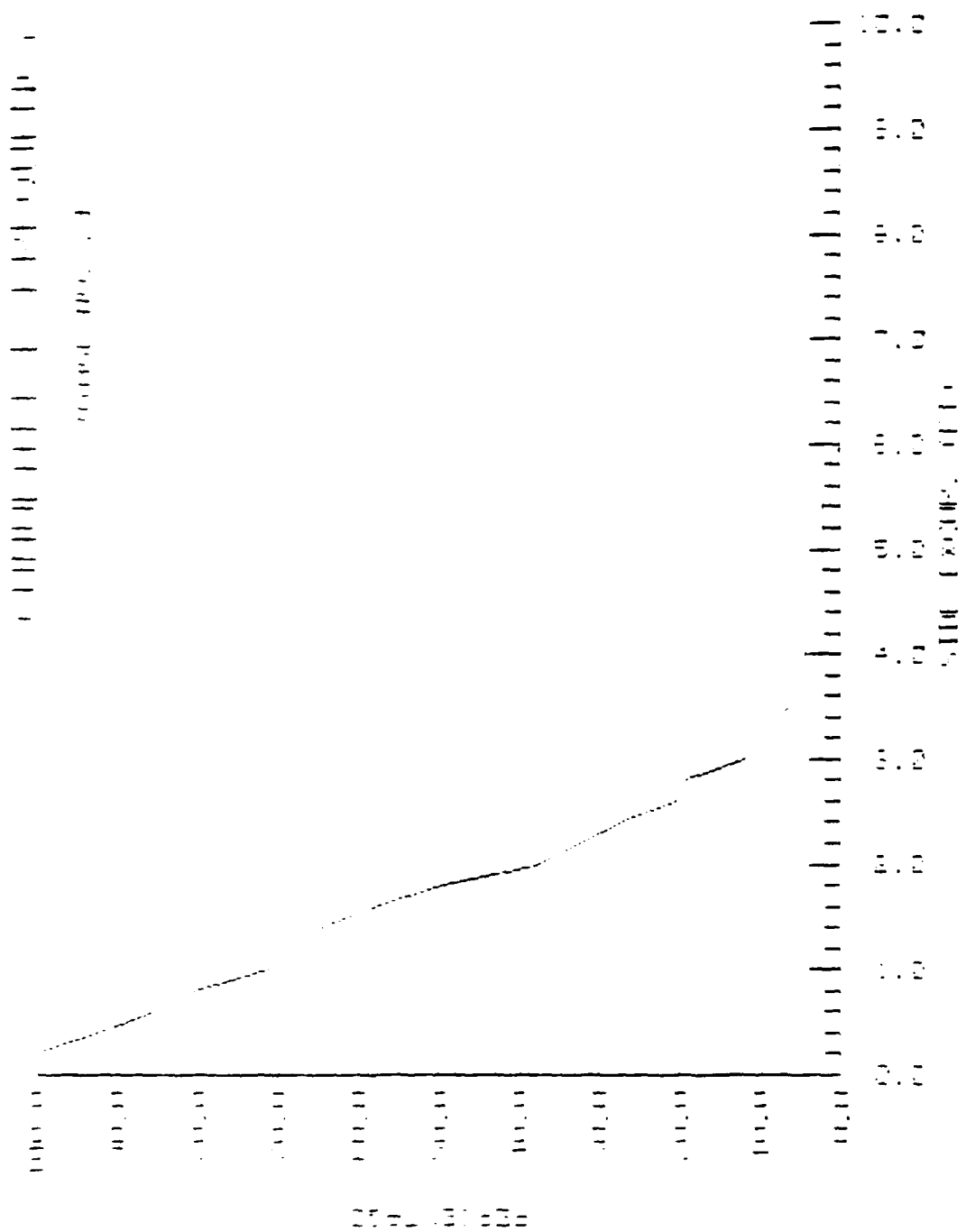


# CUMULATIVE FLOW

Figure No. 33



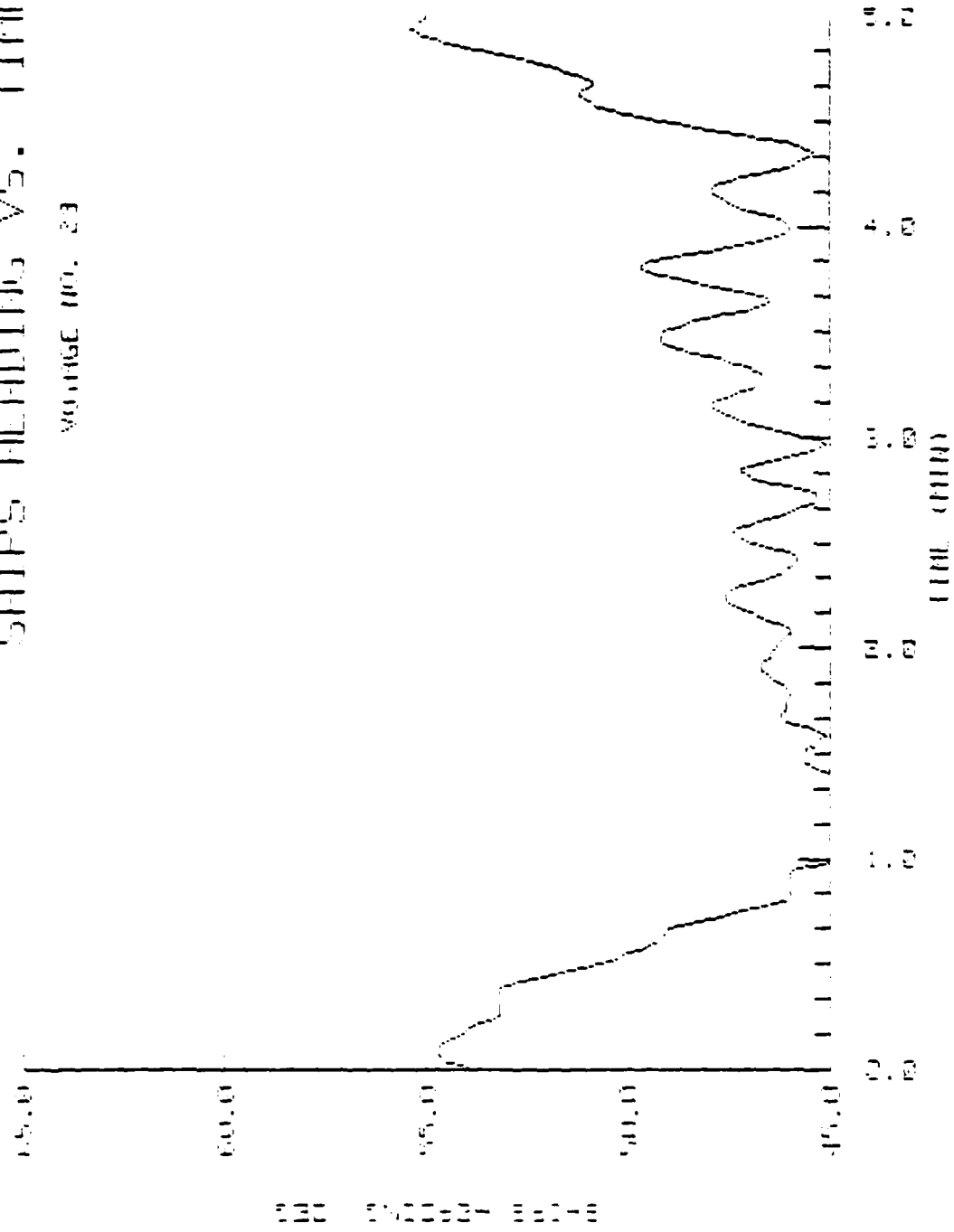






# SHIPS HEADING VS. TIME

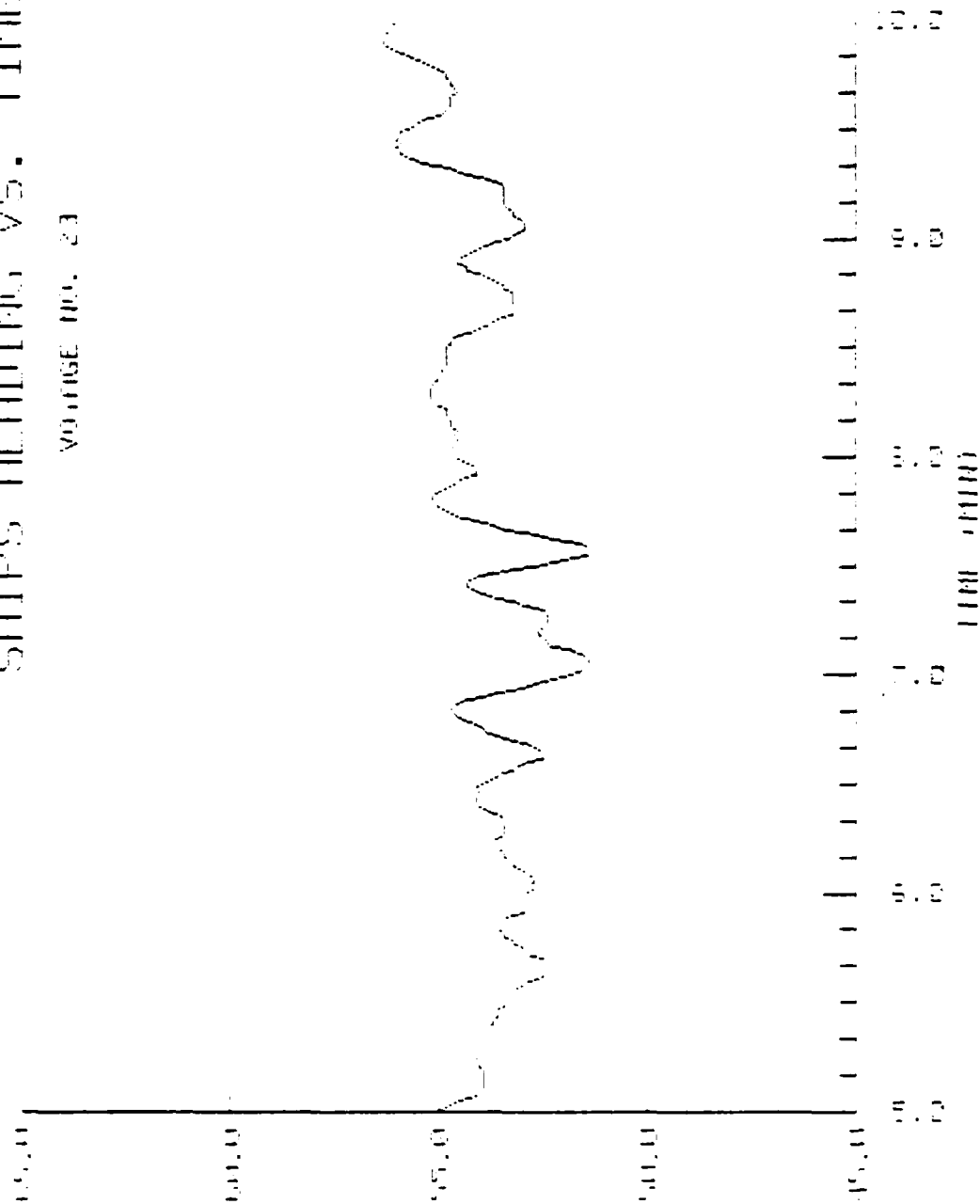
VOLUME NO. 23





# SHIPS BUILDING VS. TIME

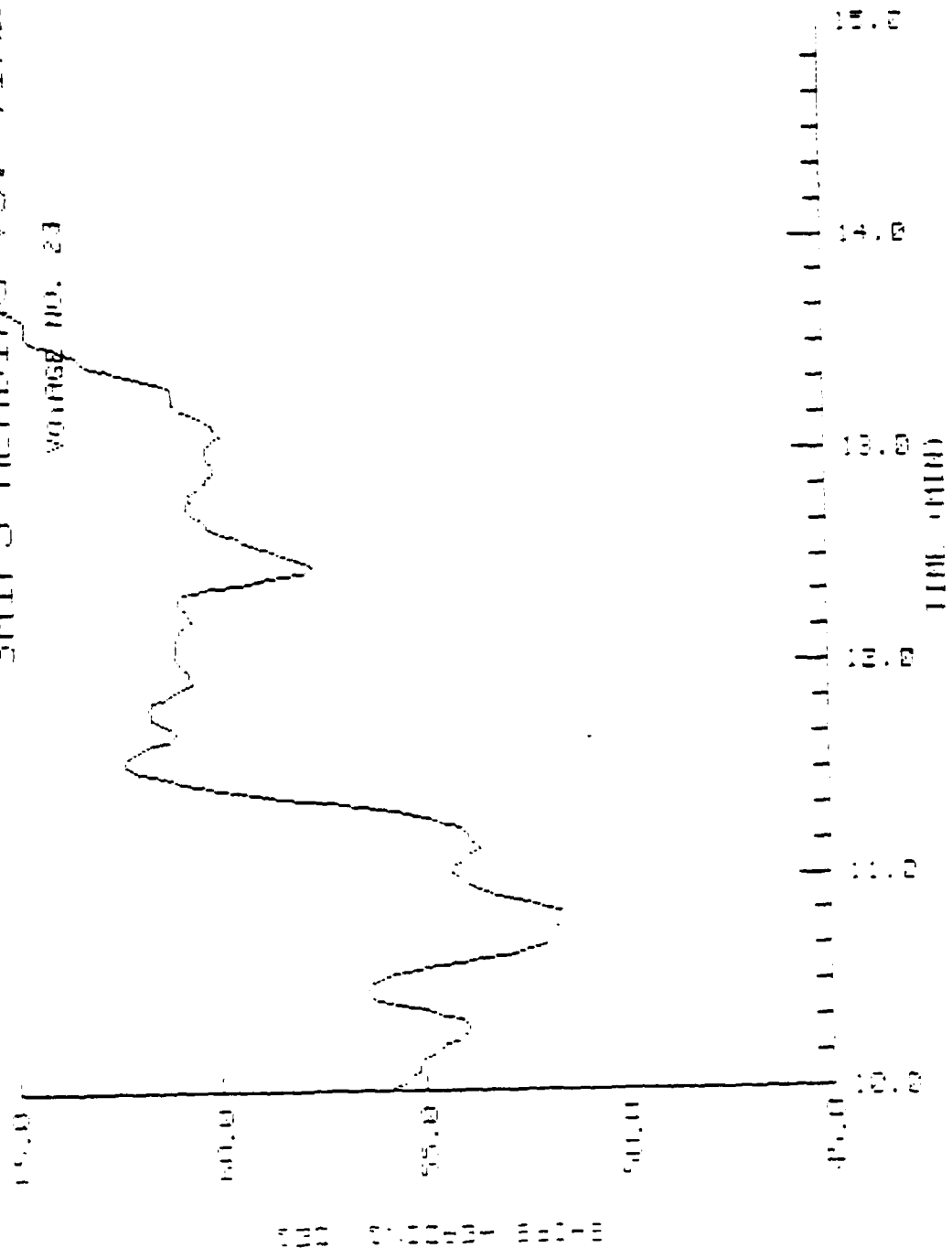
VOLUME NO. 23





# SHIPS HEADING VS. TIME

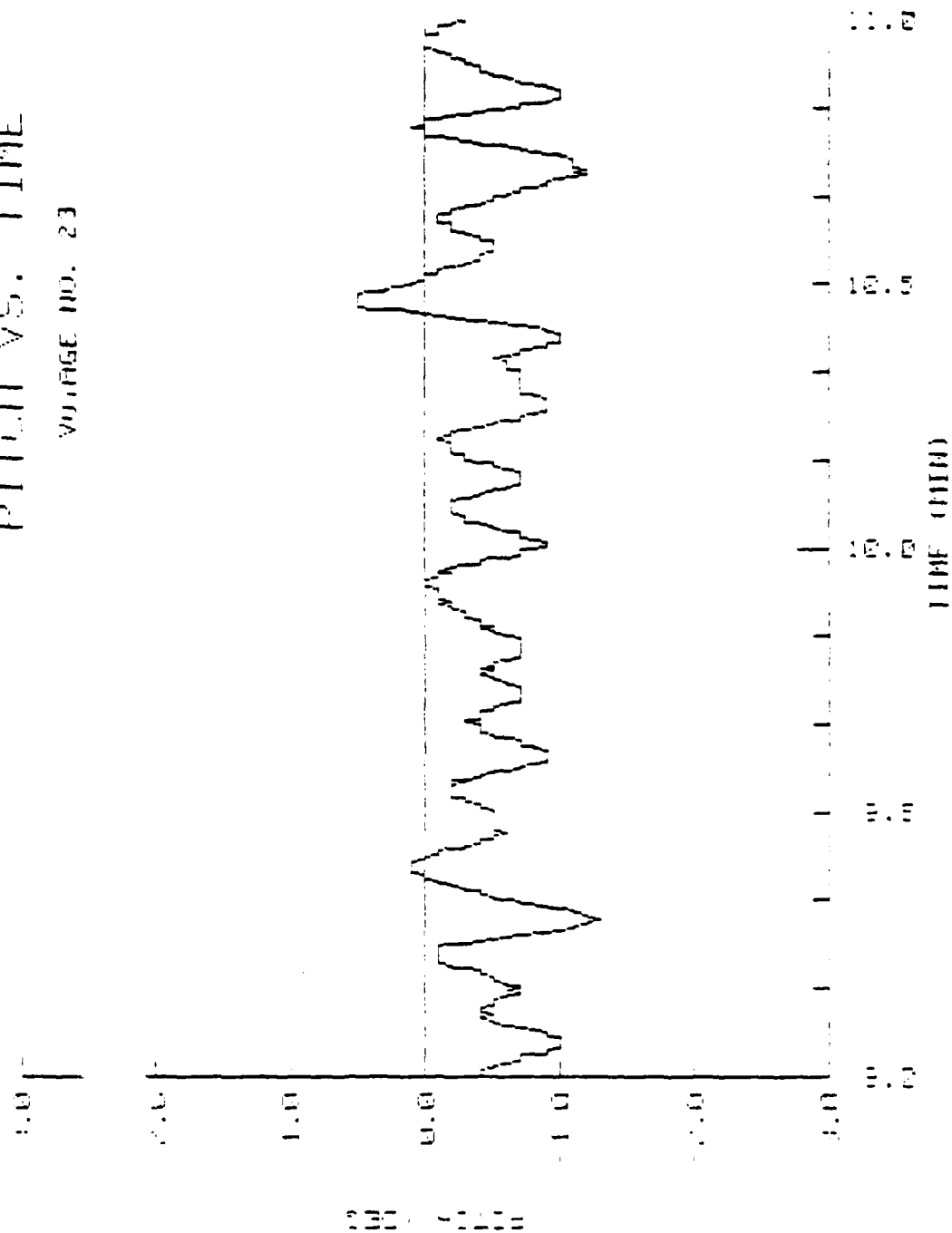
VOYAGE NO. 23





# PITCH VS. TIME

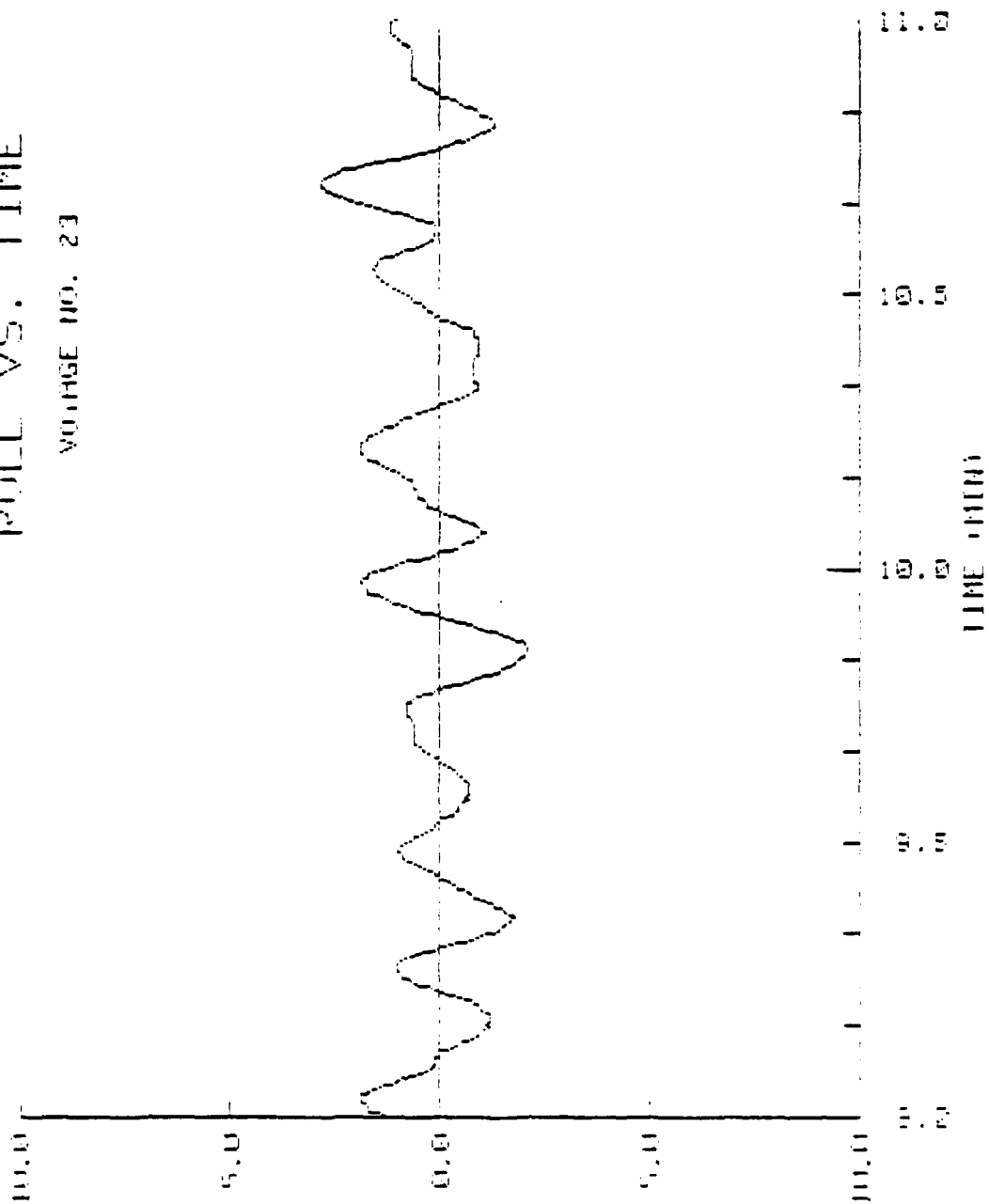
VOLUME NO. 23





# ROLL VS. TIME

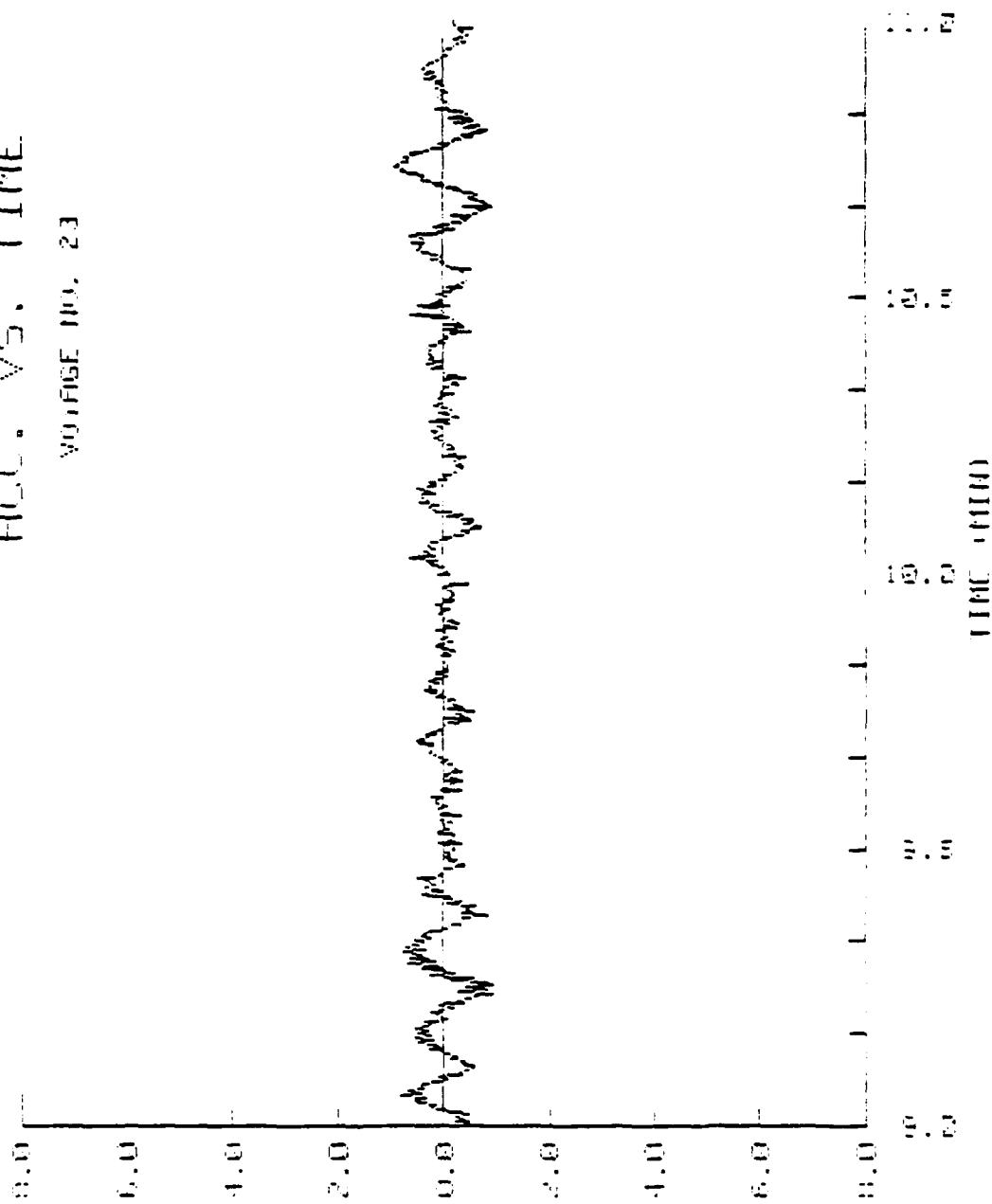
VOLUME NO. 23





# ACC. VS. TIME

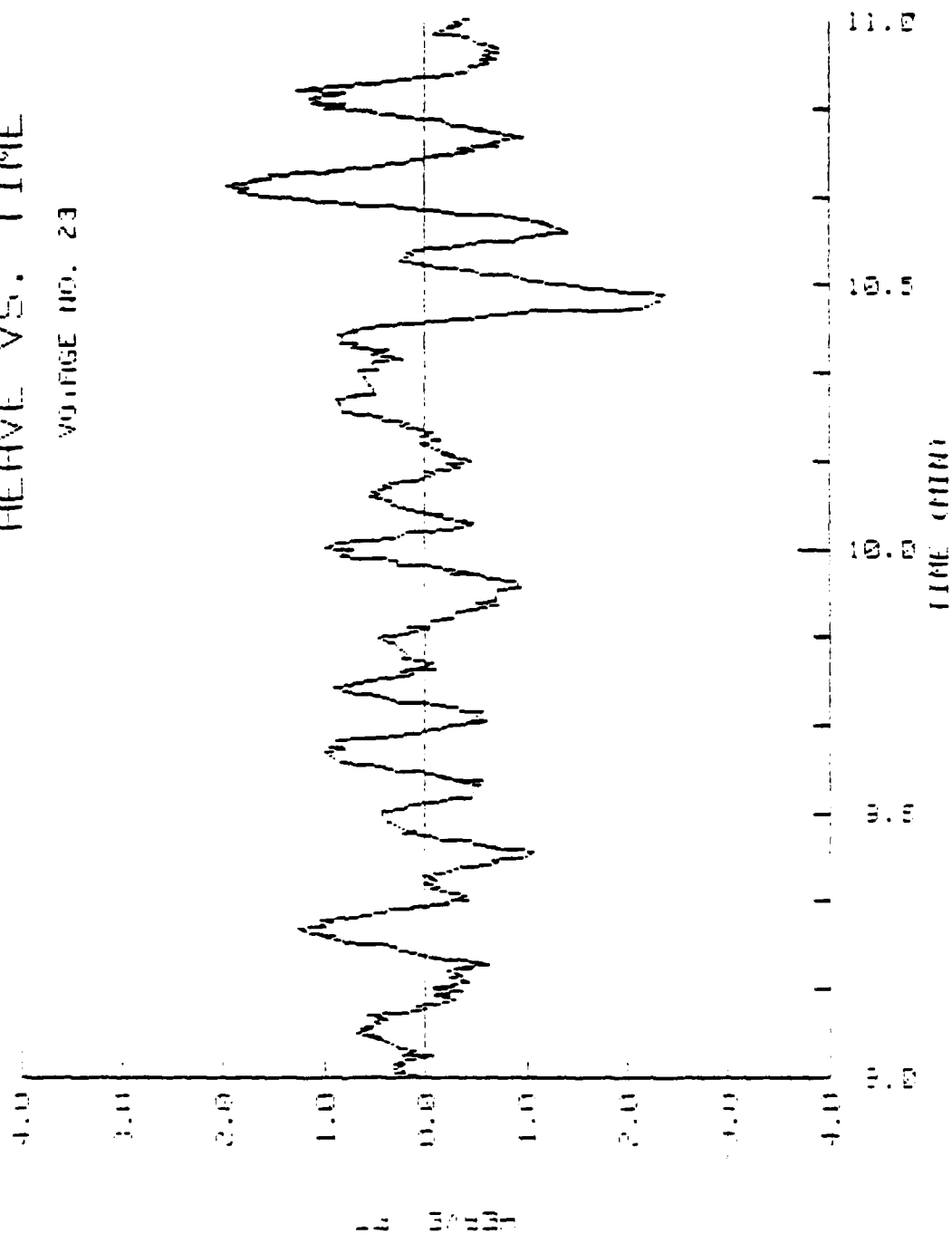
VOLUME NO. 23





# HEAVE VS. TIME

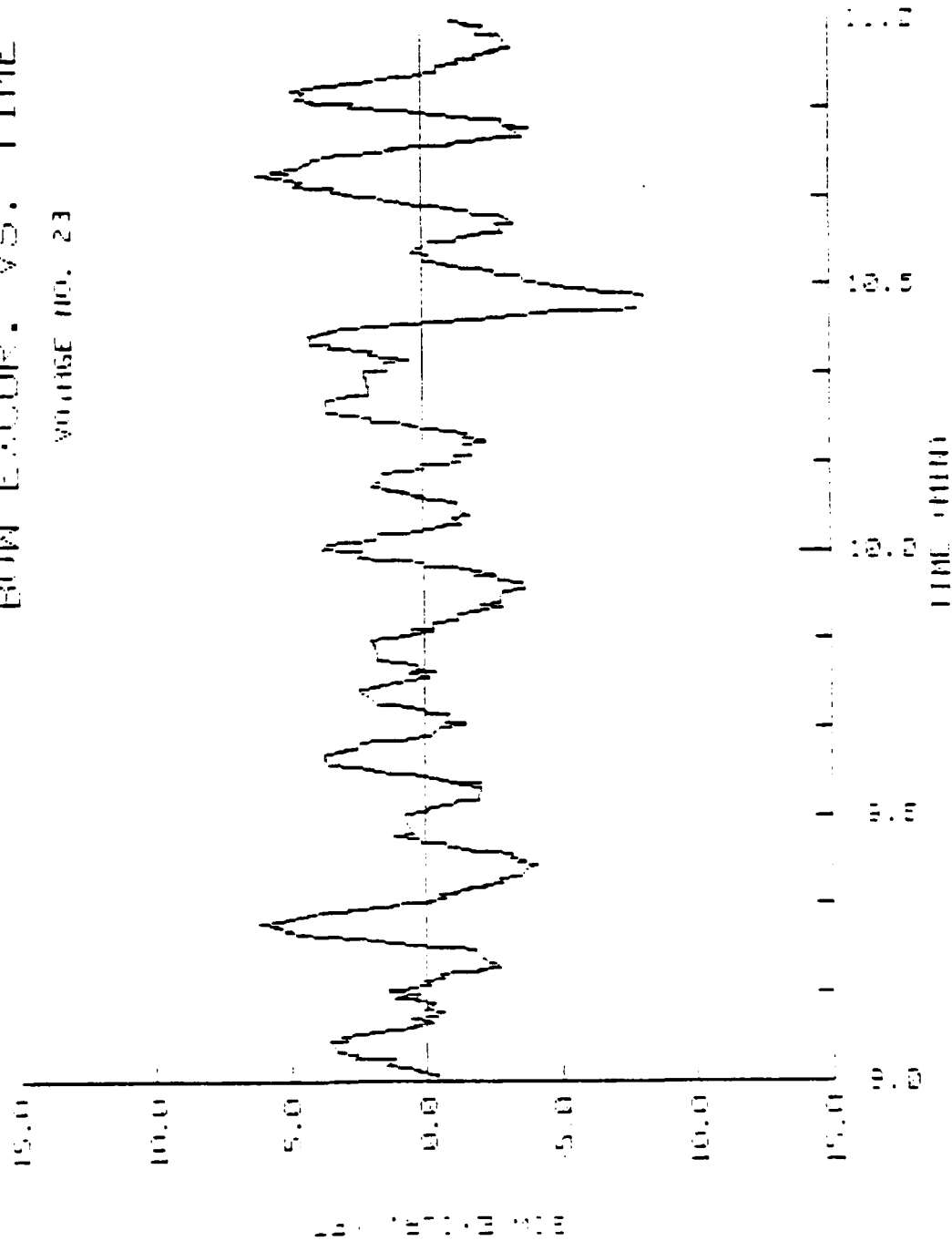
WAVE NO. 23





BOW EXCUR. VS. TIME

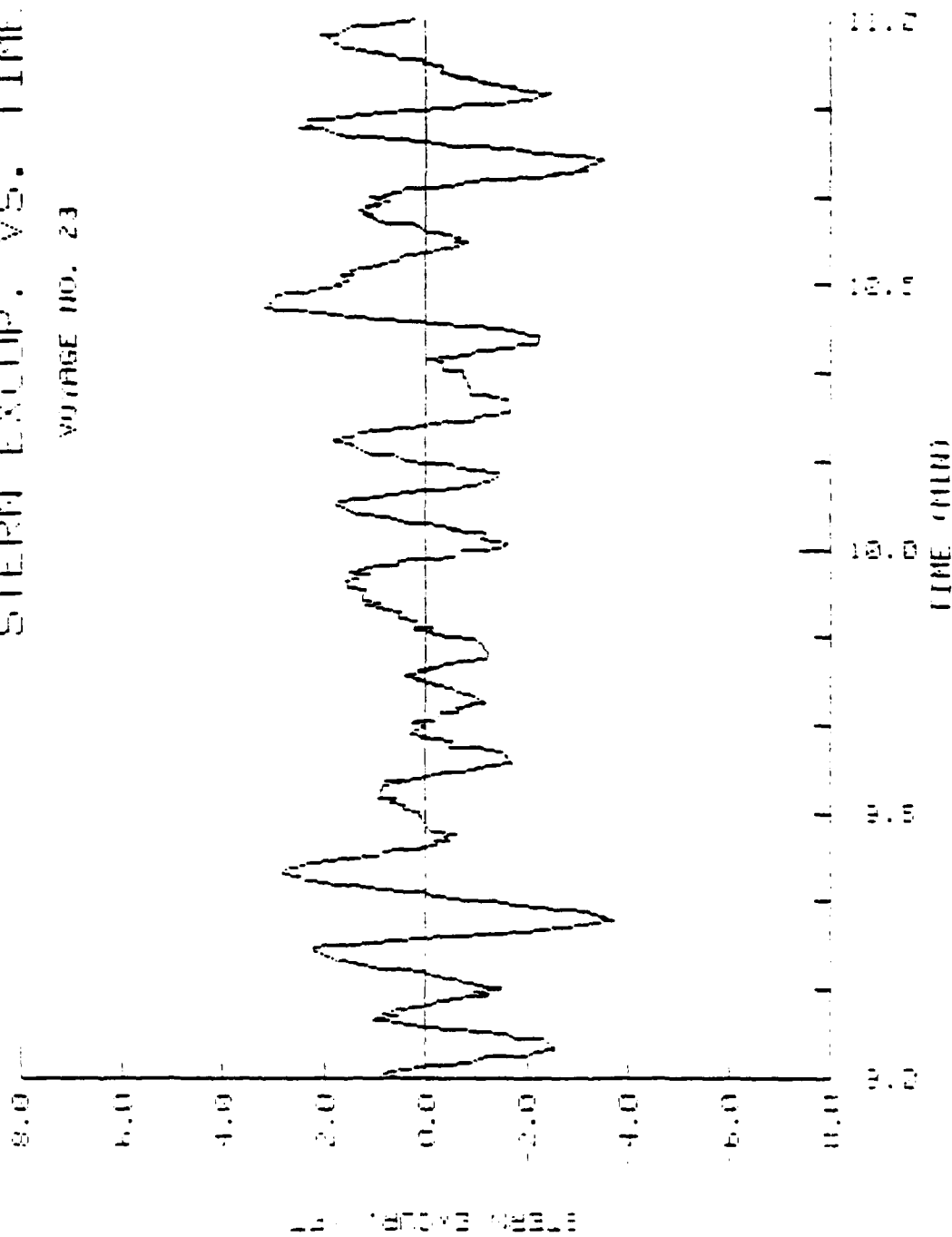
VOLUME NO. 23





# STERN EXCIP. VS. TIME

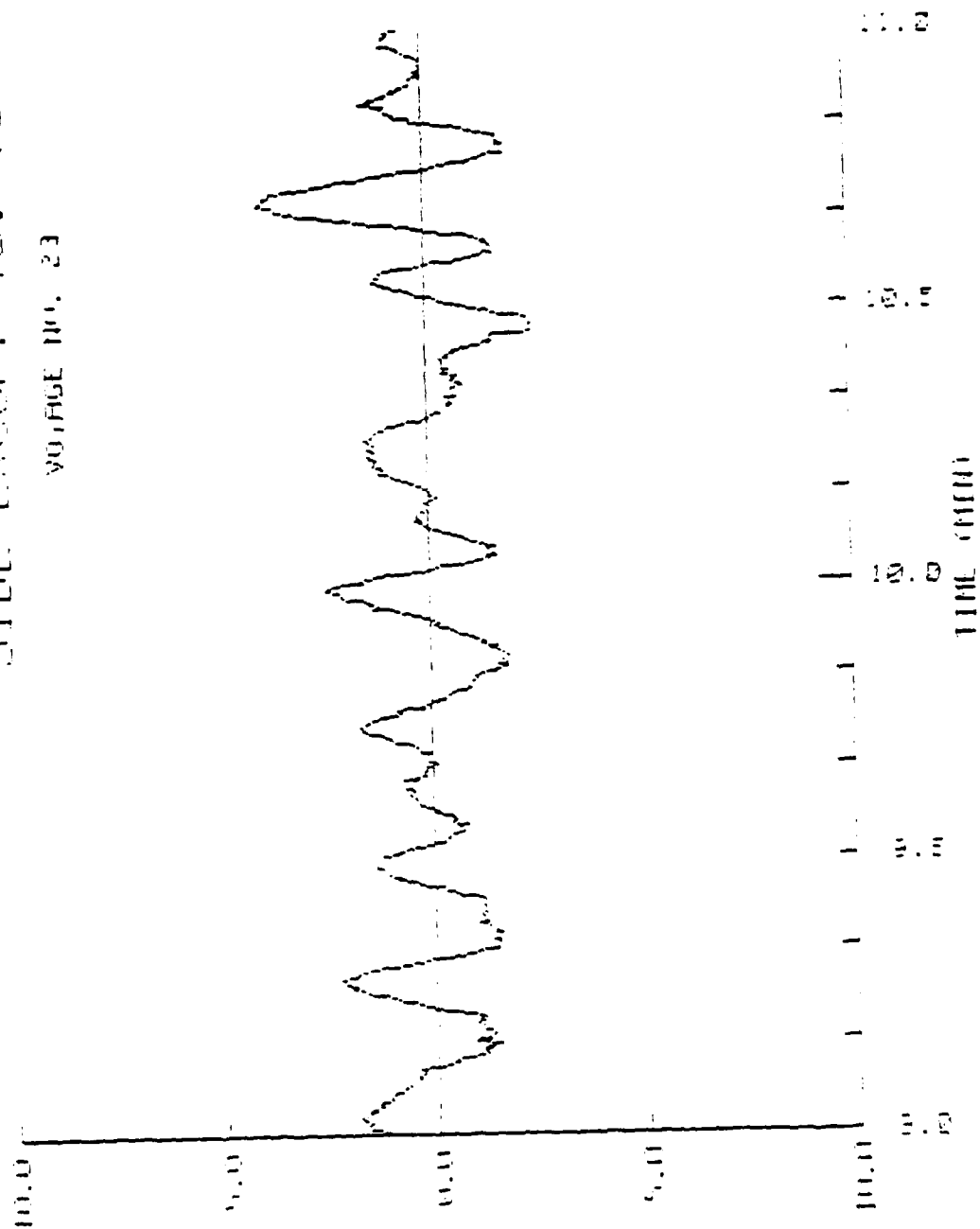
VOLUME NO. 23





# SIDE SCUP. VS. TIME

VOLUME NO. 23





# STATISTICAL SUMMARY

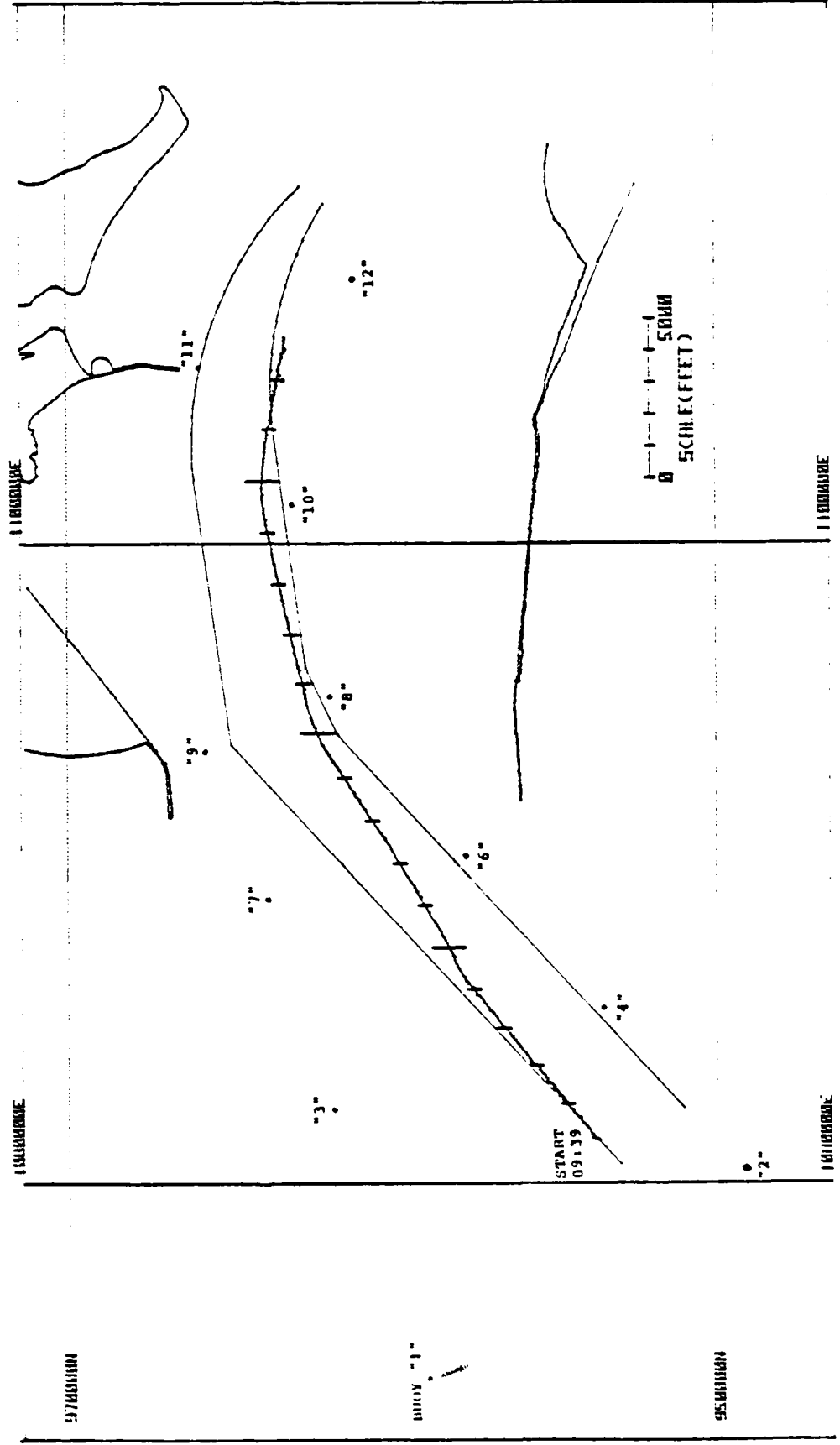
VOYAGE NO. 24

	HEMM LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	PNS
PITCH (DEG)	-0.4	.8	.3	.3
ROLL (DEG)	-0.0	4.3	1.7	2.0
HEAVE (FT SEC/SEC)	.1	1.4	.6	.7
ROLL (FT)	.0	1.4	.6	.7
ROLL EXCUR. (FT)	.0	5.8	1.8	2.2
ROLL EXCUR. (FT)	.0	3.3	1.2	1.4
ROLL EXCUR. (FT)	.0	3.7	1.7	1.9



# VIIYUIGE NO. 24 SHIP TRACK

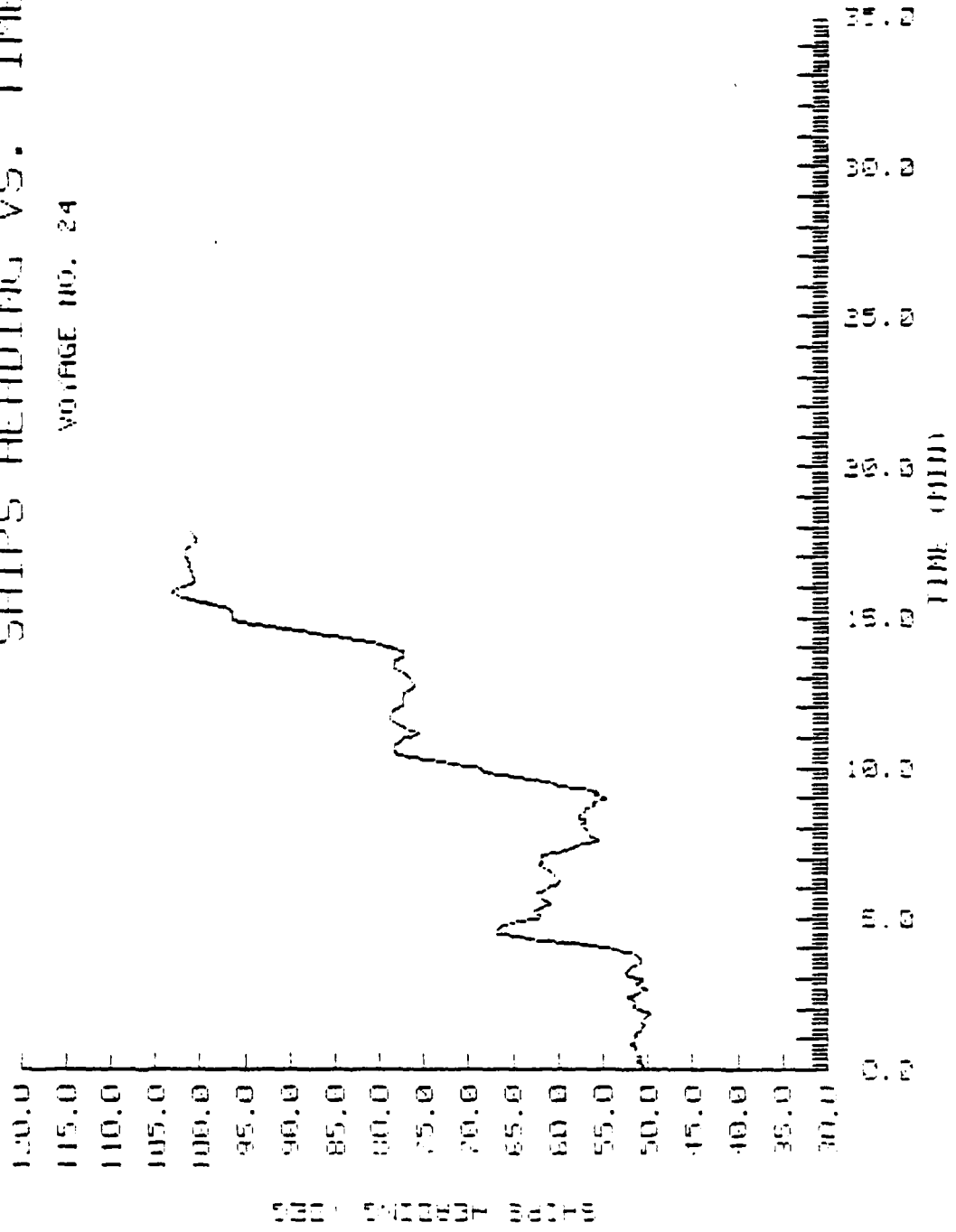
SCALE 1: 30000





# SHIPS HEADING VS. TIME

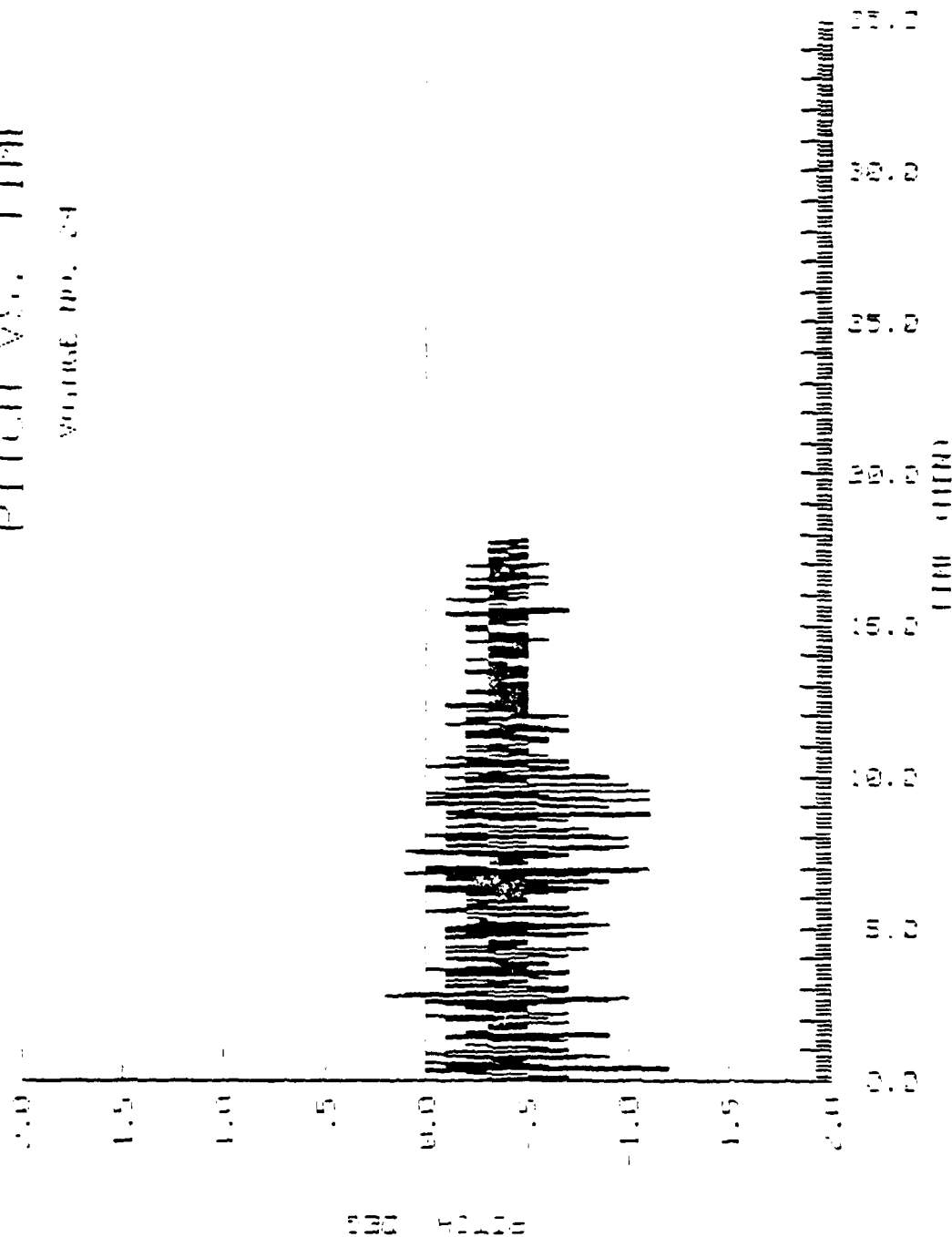
VOLTAIR 110. 24





# PITCH VOLT. TIME

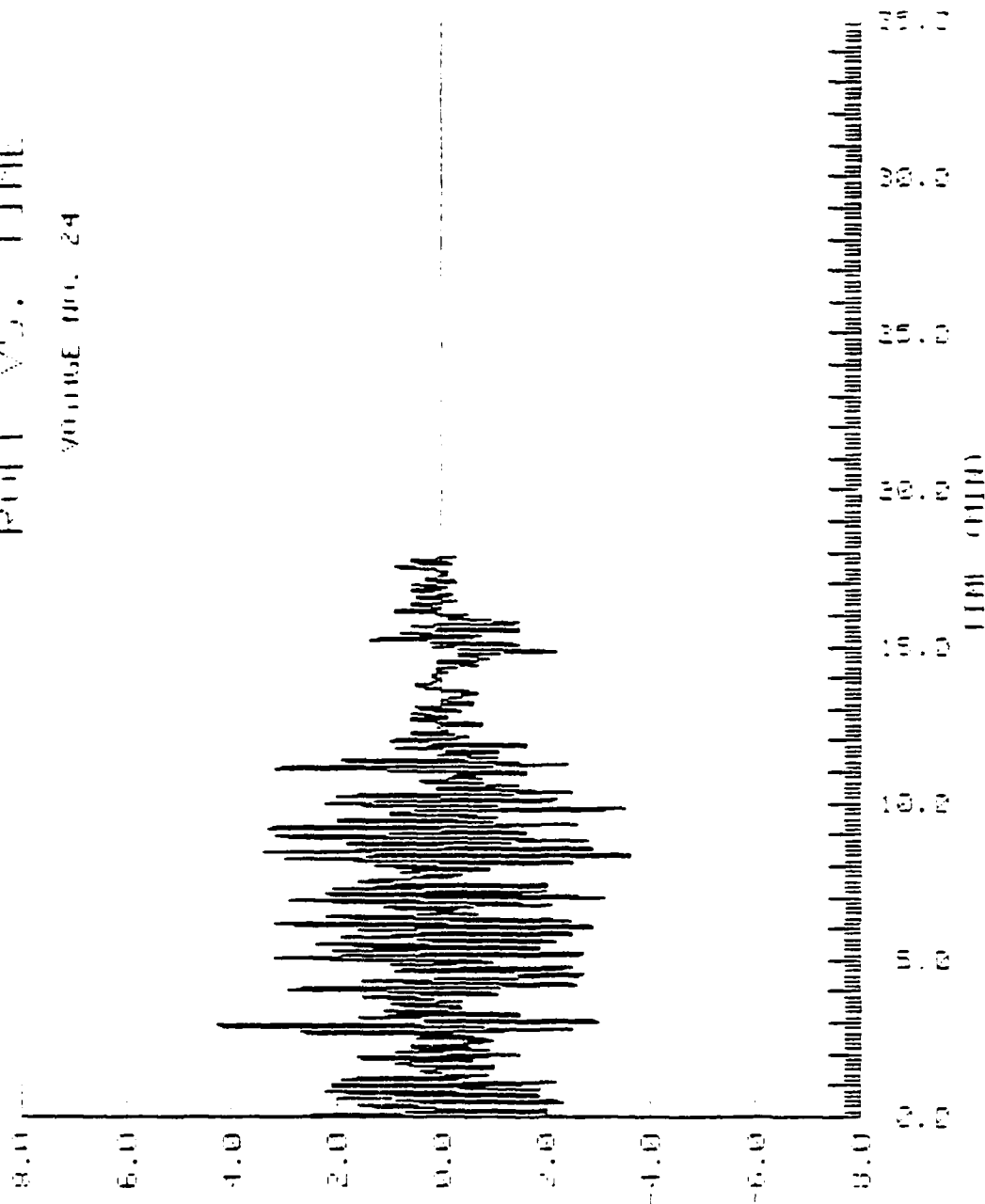
VOLUME NO. 24





POLL VS. TIME

WINDMILL NO. 24

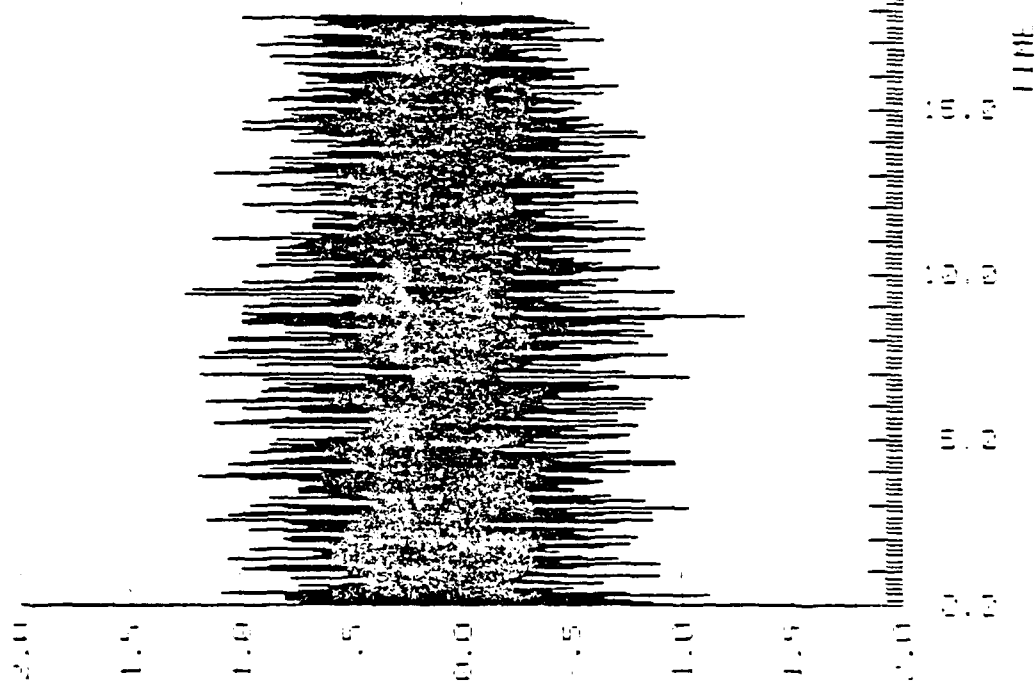


100 1700



1000. V<sub>2</sub>. FILM

VOLUME NO. 24

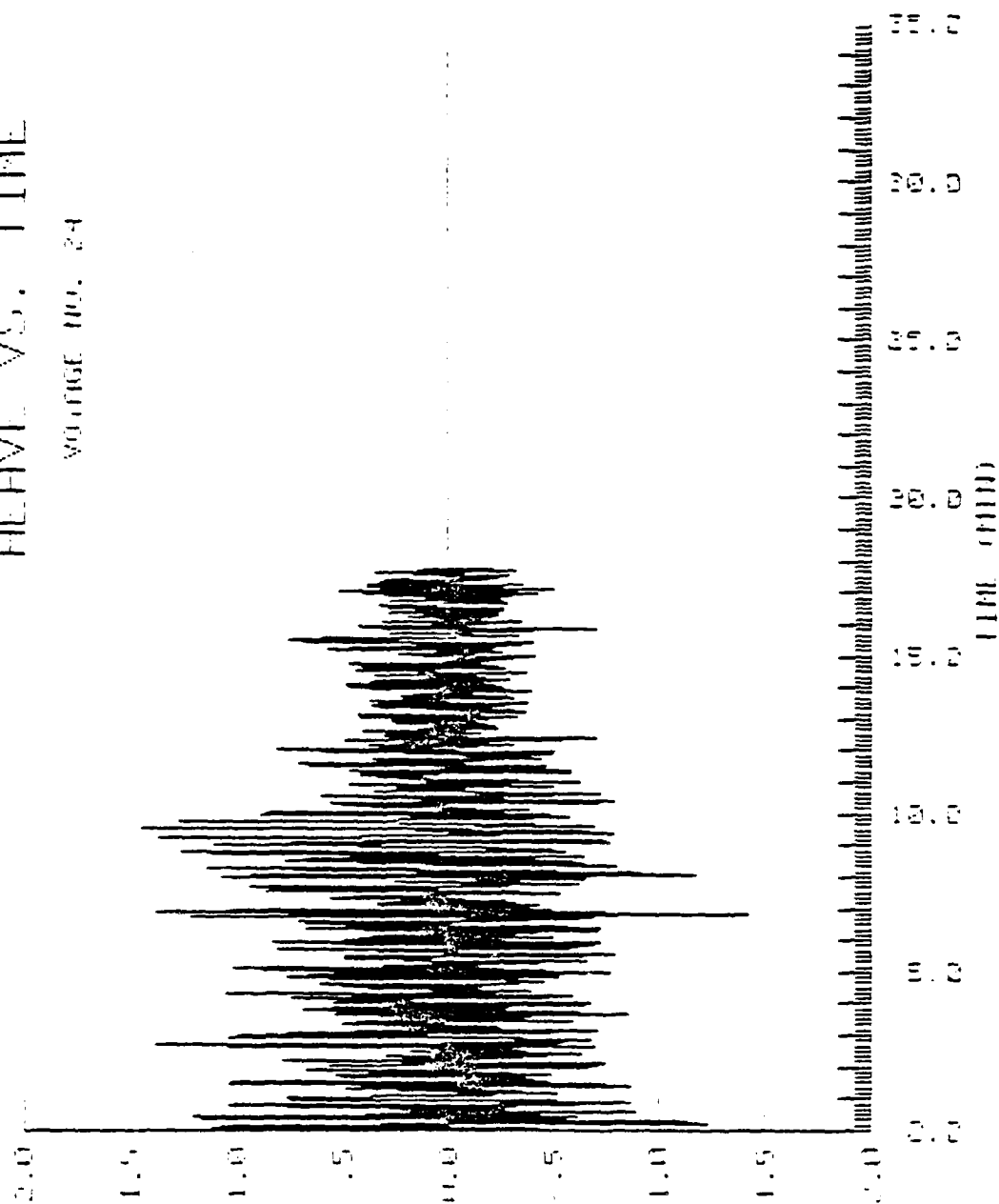


100 100 100 100



# HEAVE VS. TIME

VOLUME 100. 24



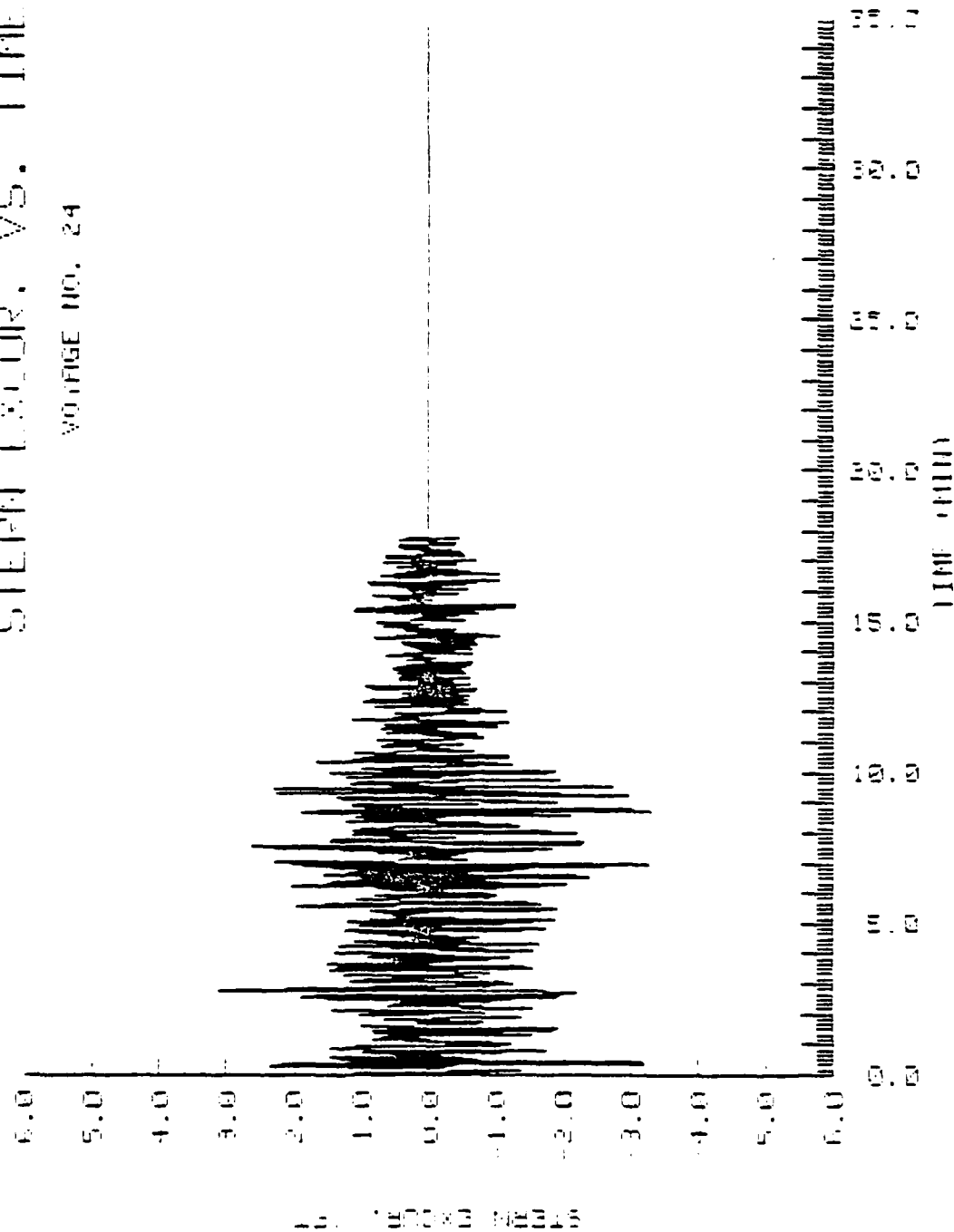






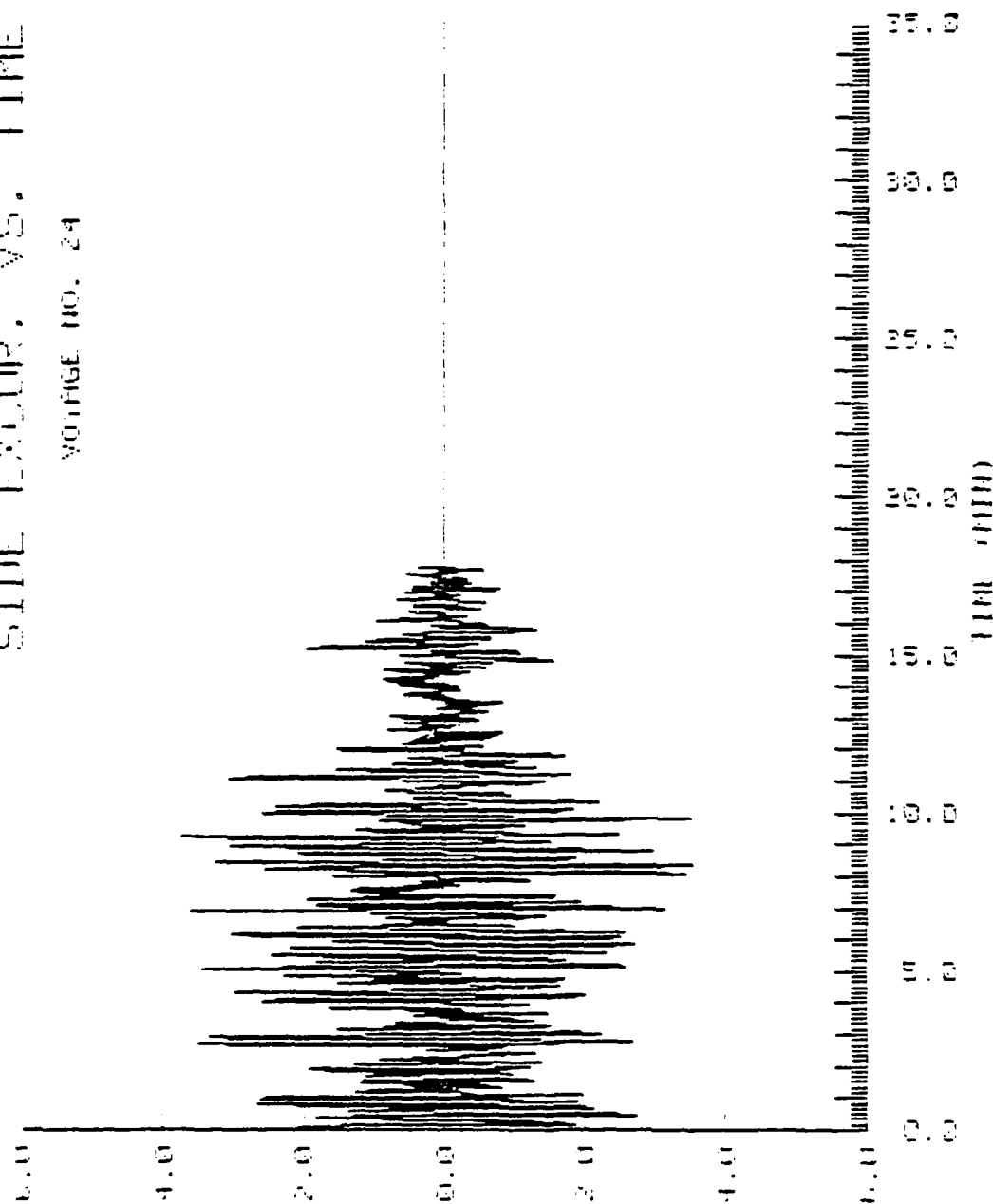
# STEPH COLLUR, VS. TIME

VOLUME NO. 24





VOYAGE NO. 24

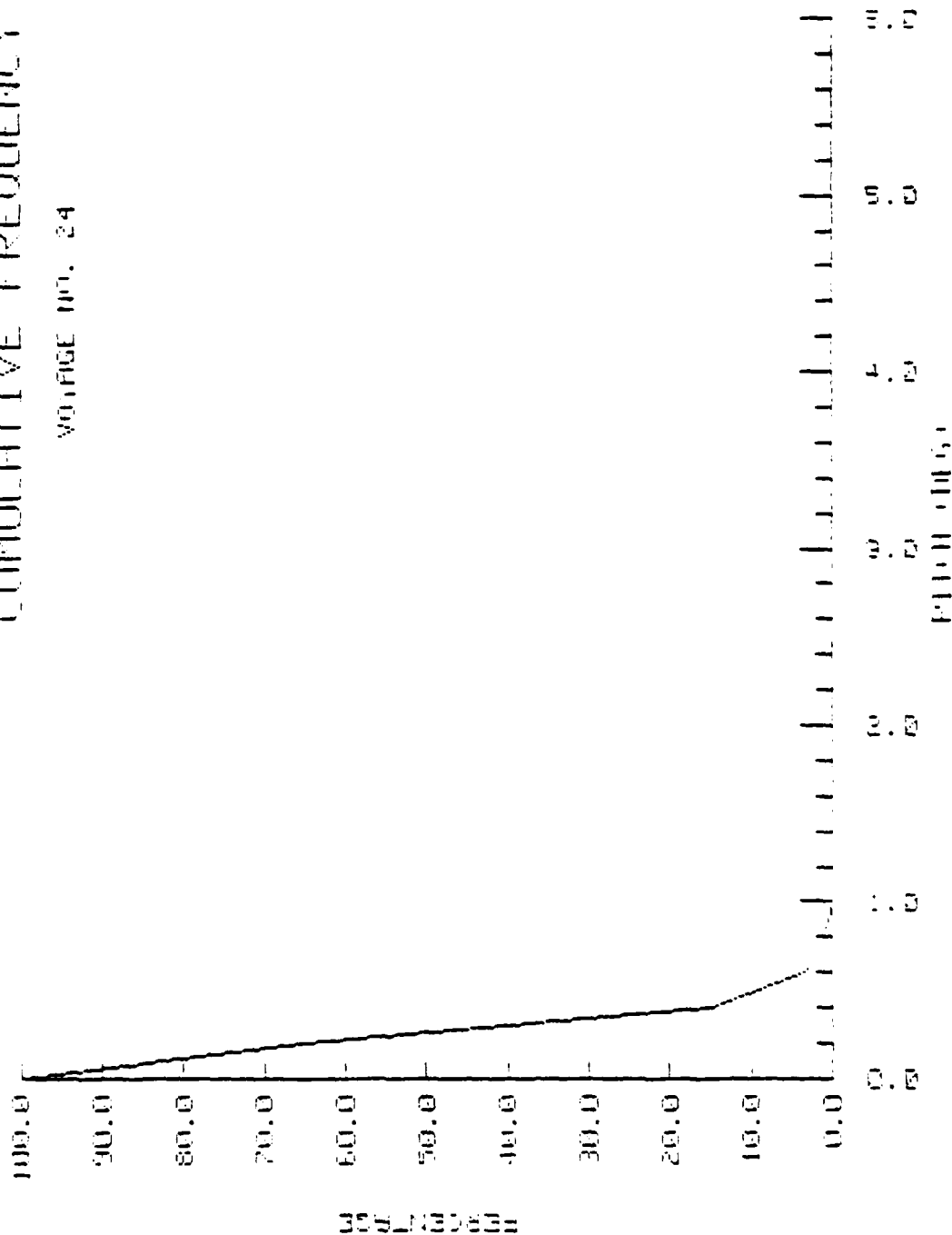


100-443887-1



# CUMULATIVE FREQUENCY

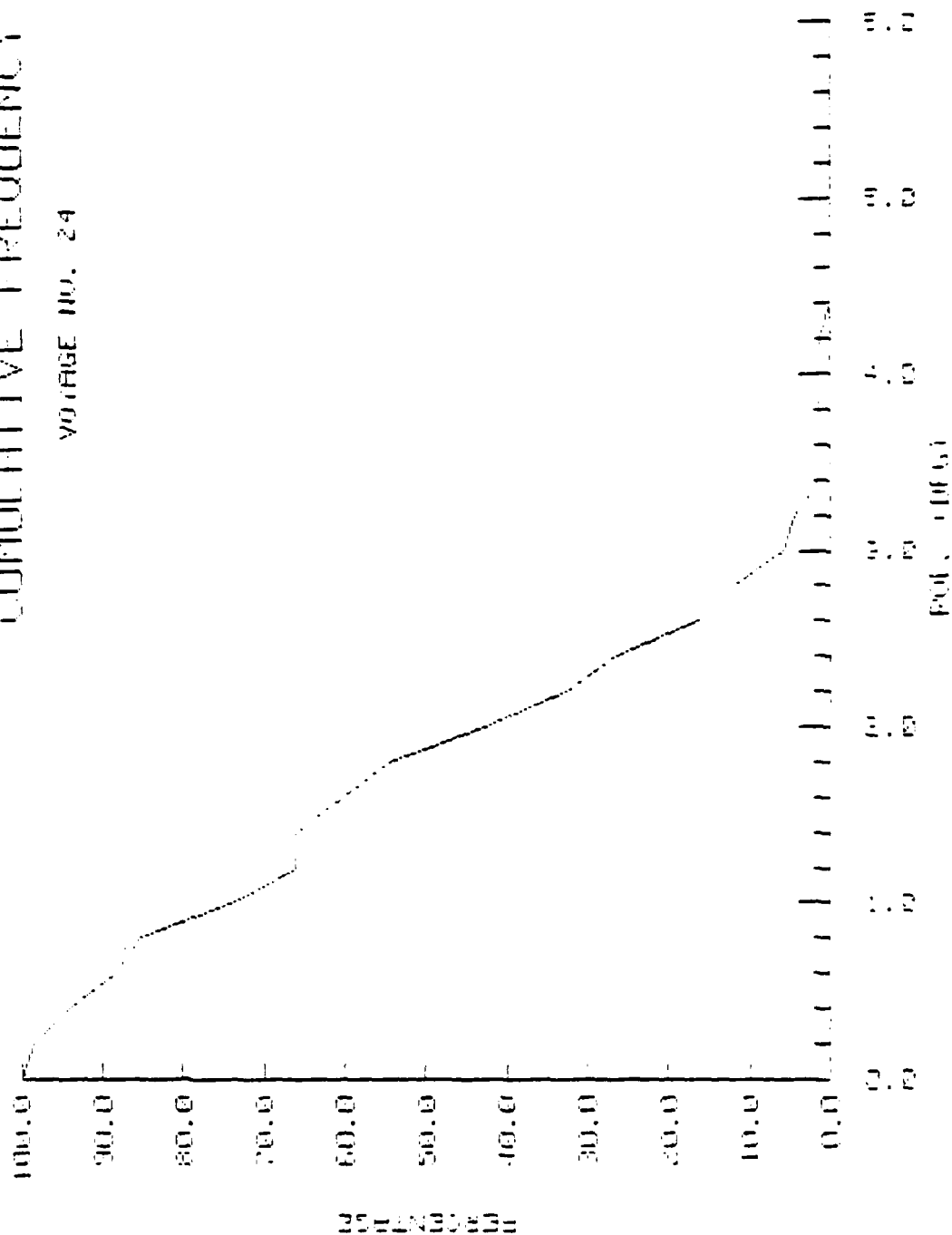
VOLUME NO. 24





# CUMULATIVE FREQUENCY

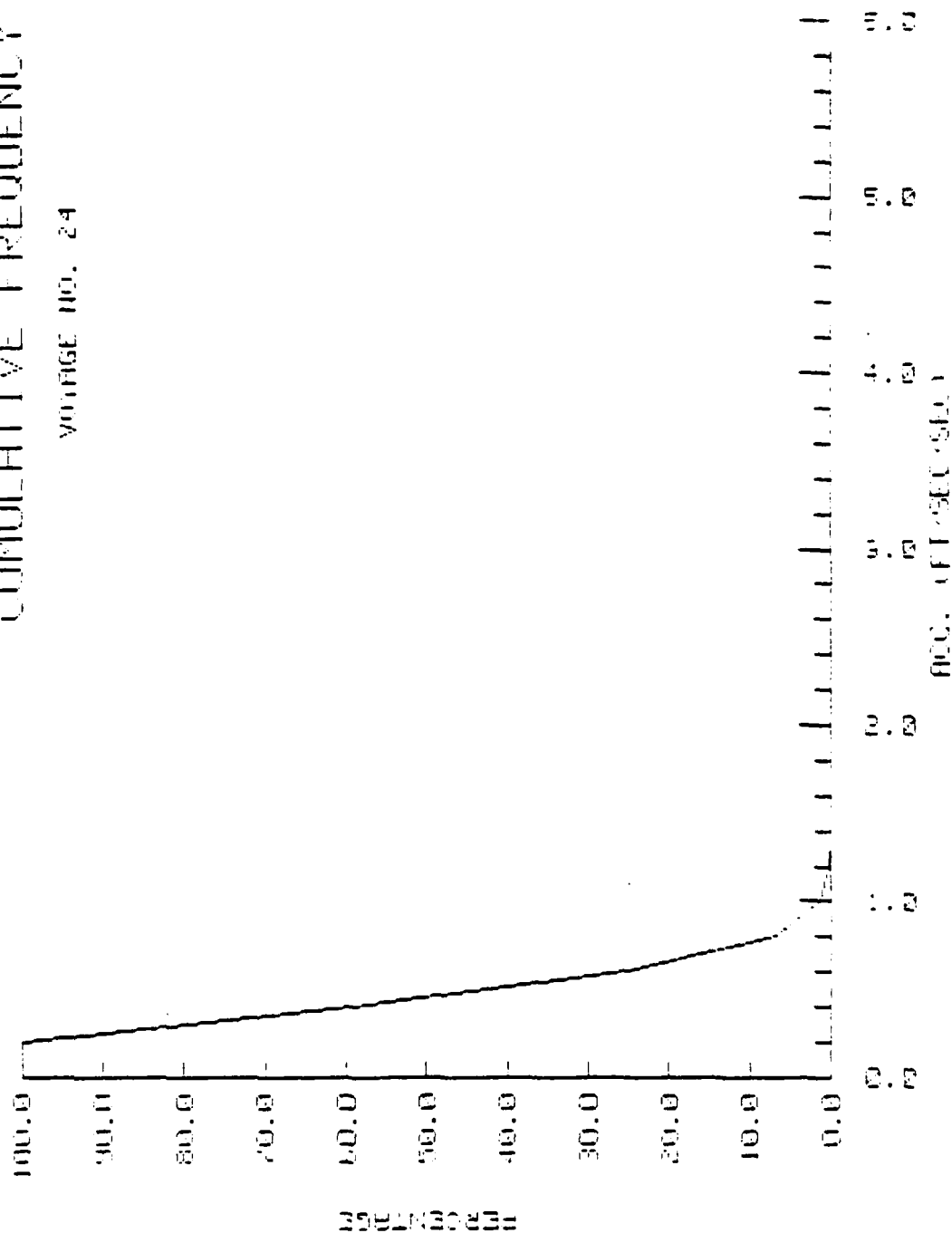
VOLUME NO. 24





# CUMULATIVE FREQUENCY

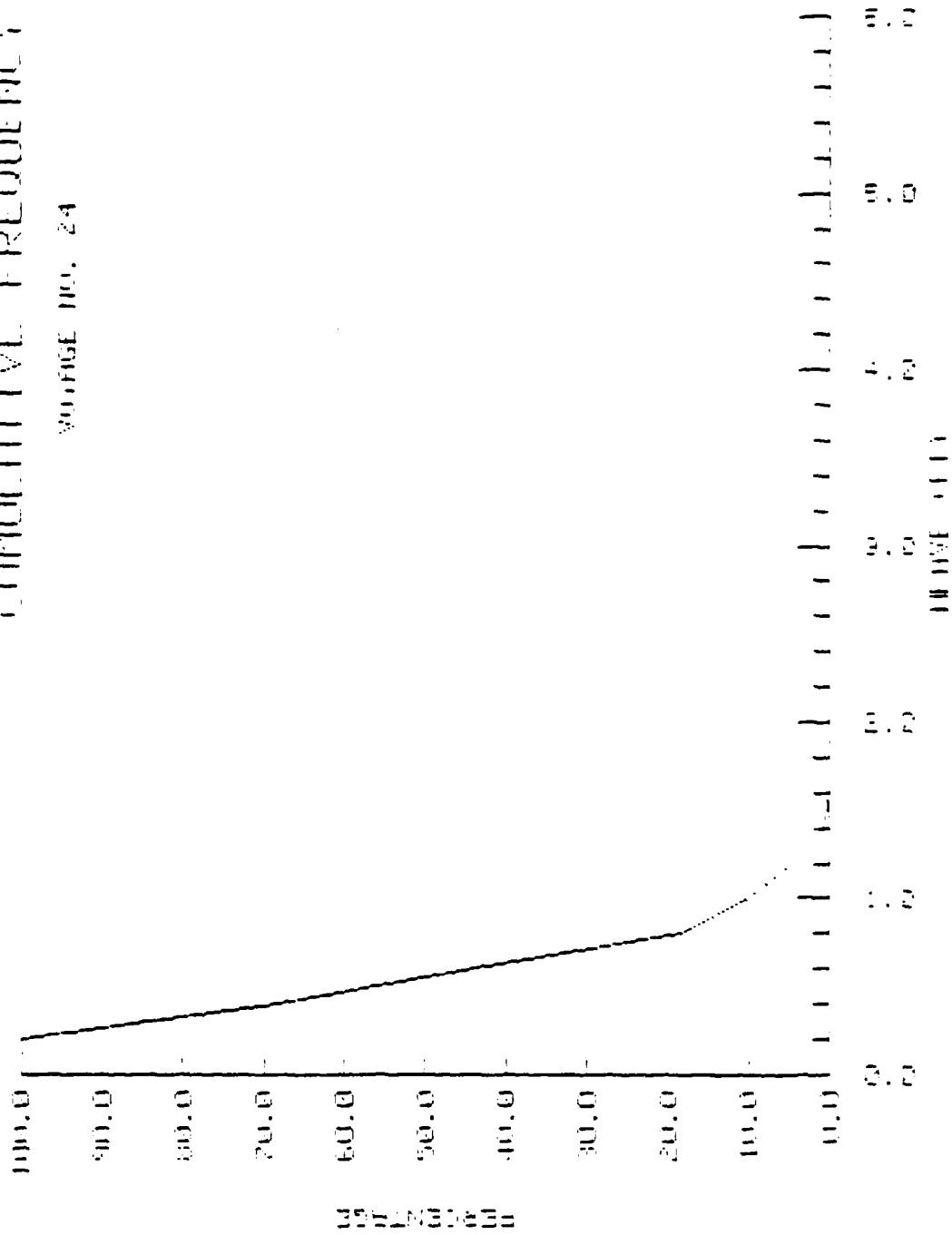
VOLUME NO. 24





# CUMULATIVE FREQUENCY

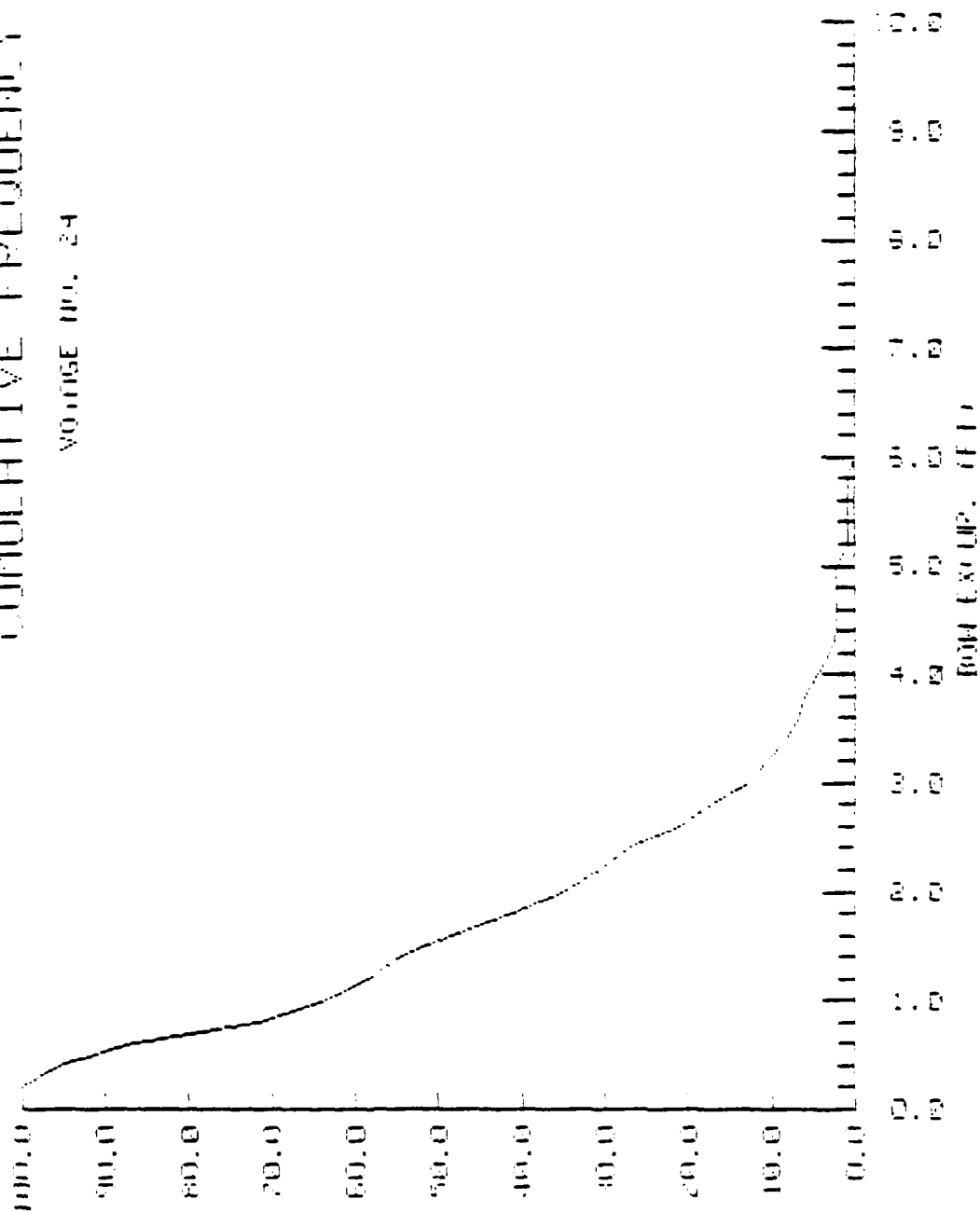
VOYAGE NO. 24





# COMPULSIVE FREQUENCY

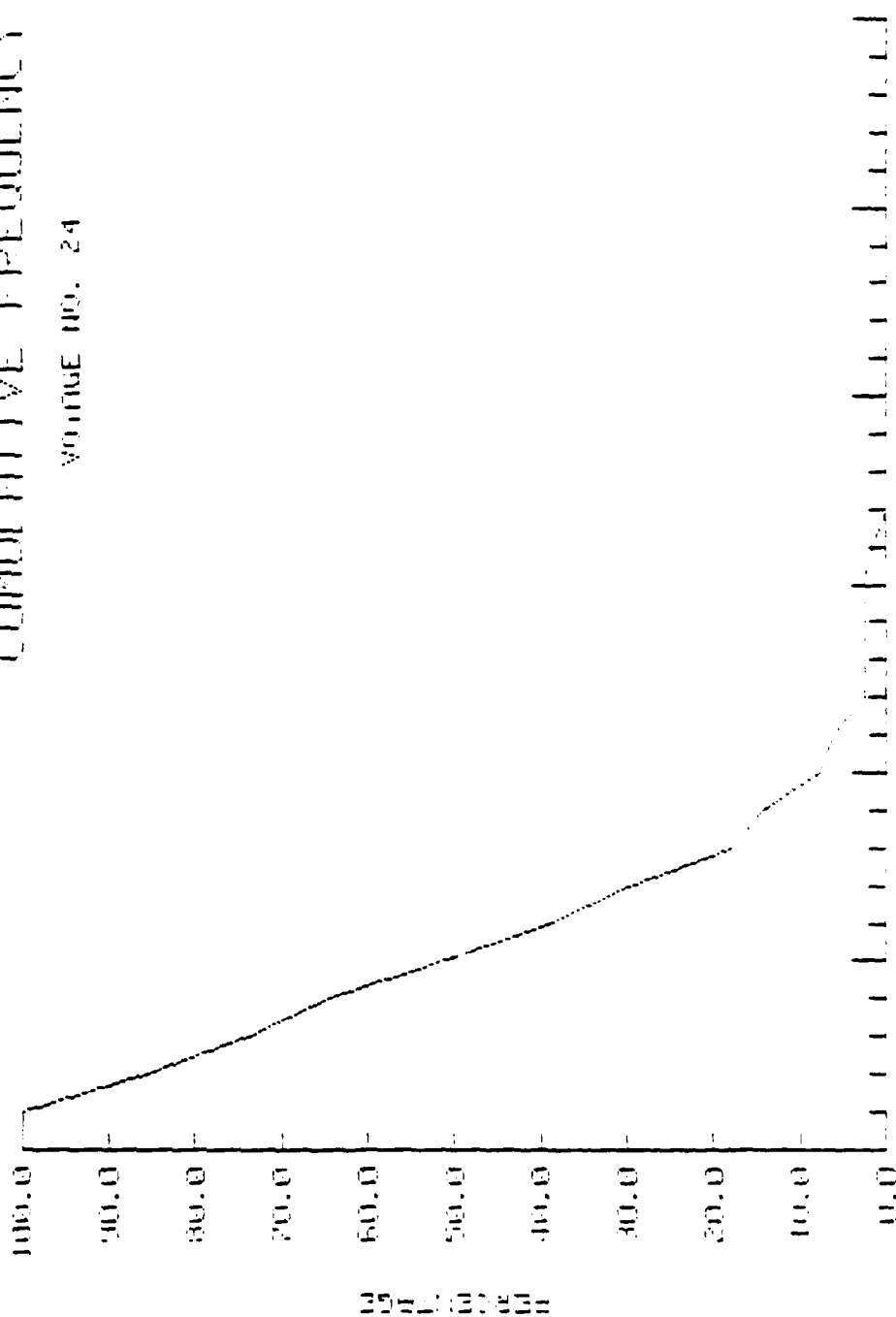
VOYAGE III. 24





# CUMULATIVE FREQUENCY

VOLUME NO. 24

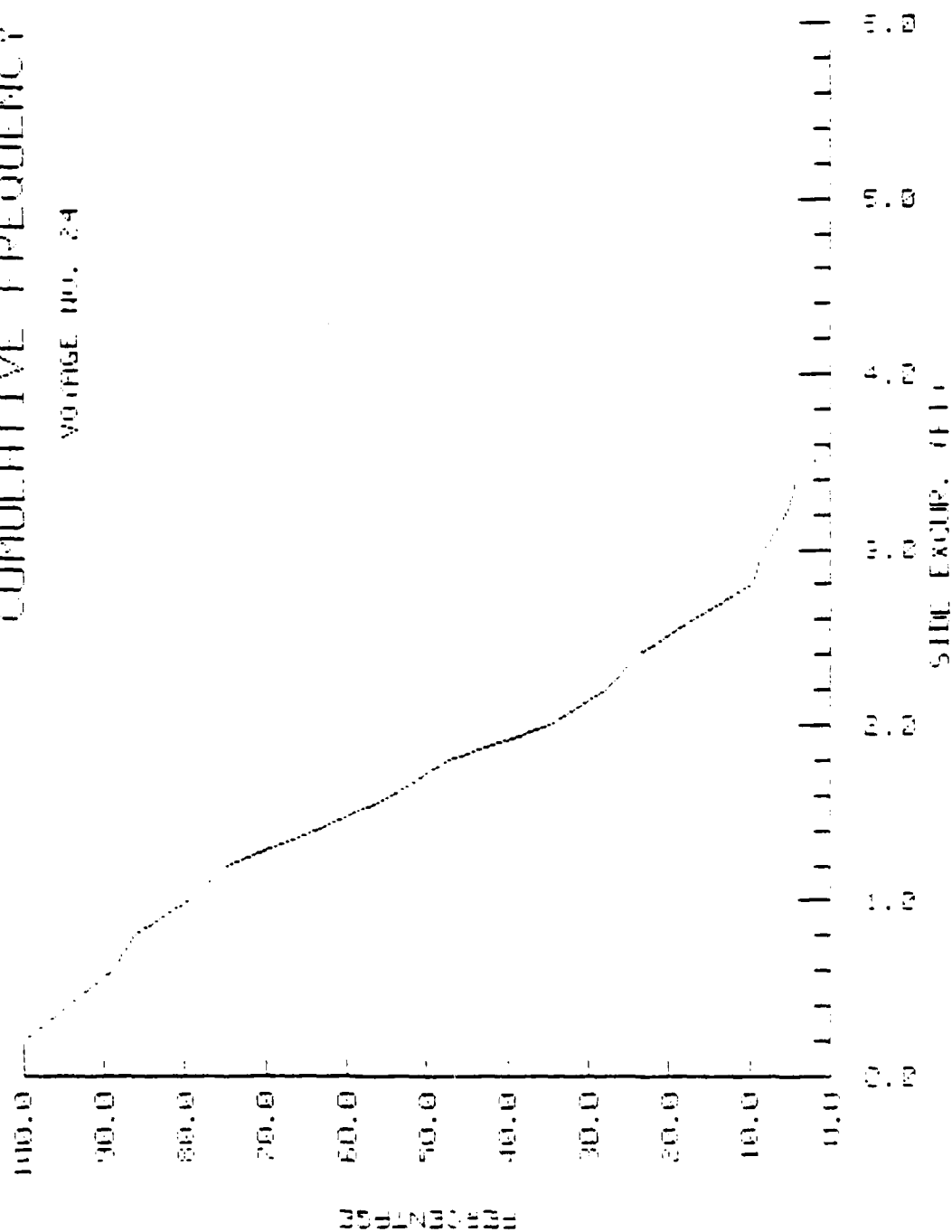


STEP (SEC. 0.1)



# CUMULATIVE FREQUENCY

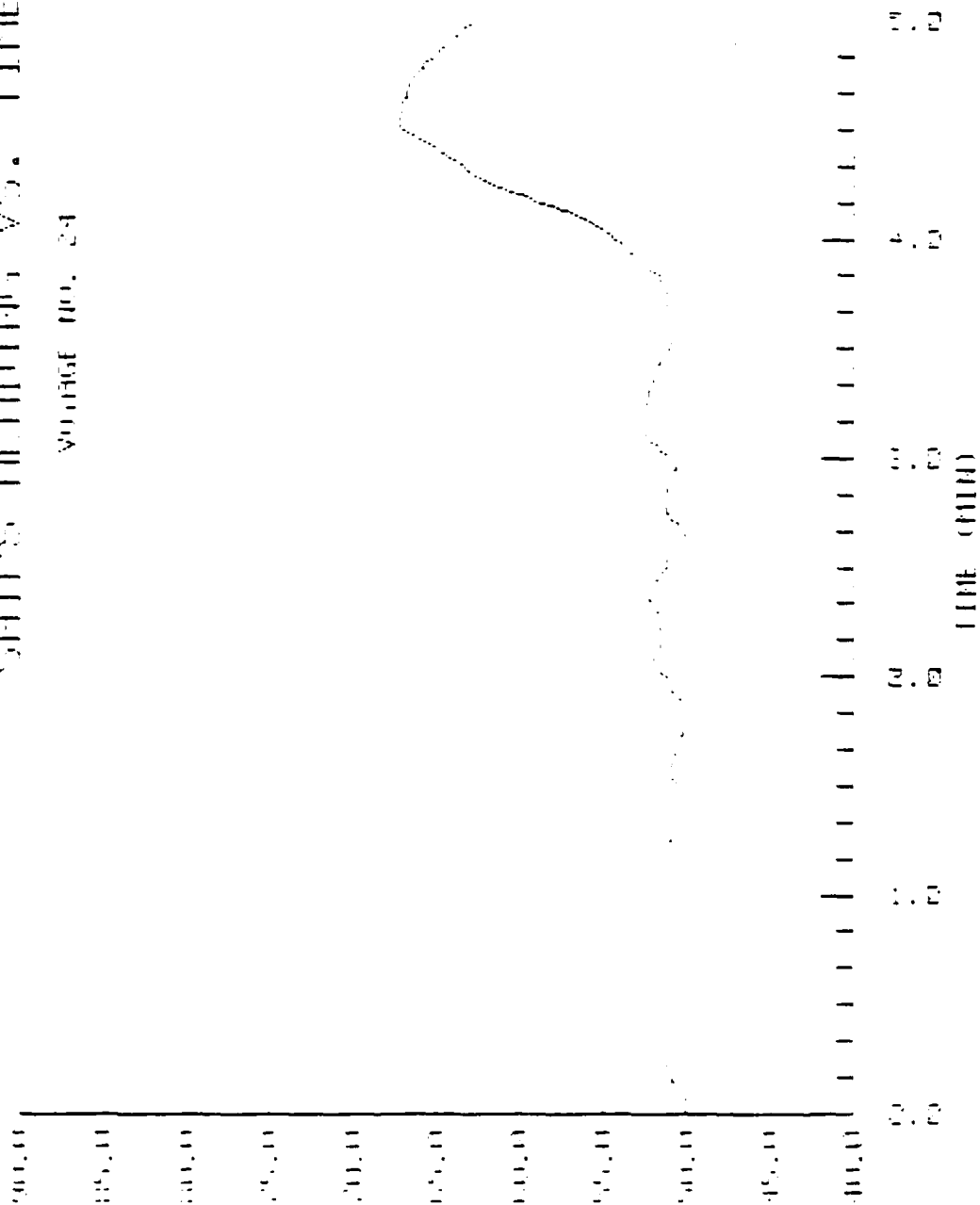
VOYAGE NO. 24





# SHIPS HULLING V% TIME

VOLUME NO. 24

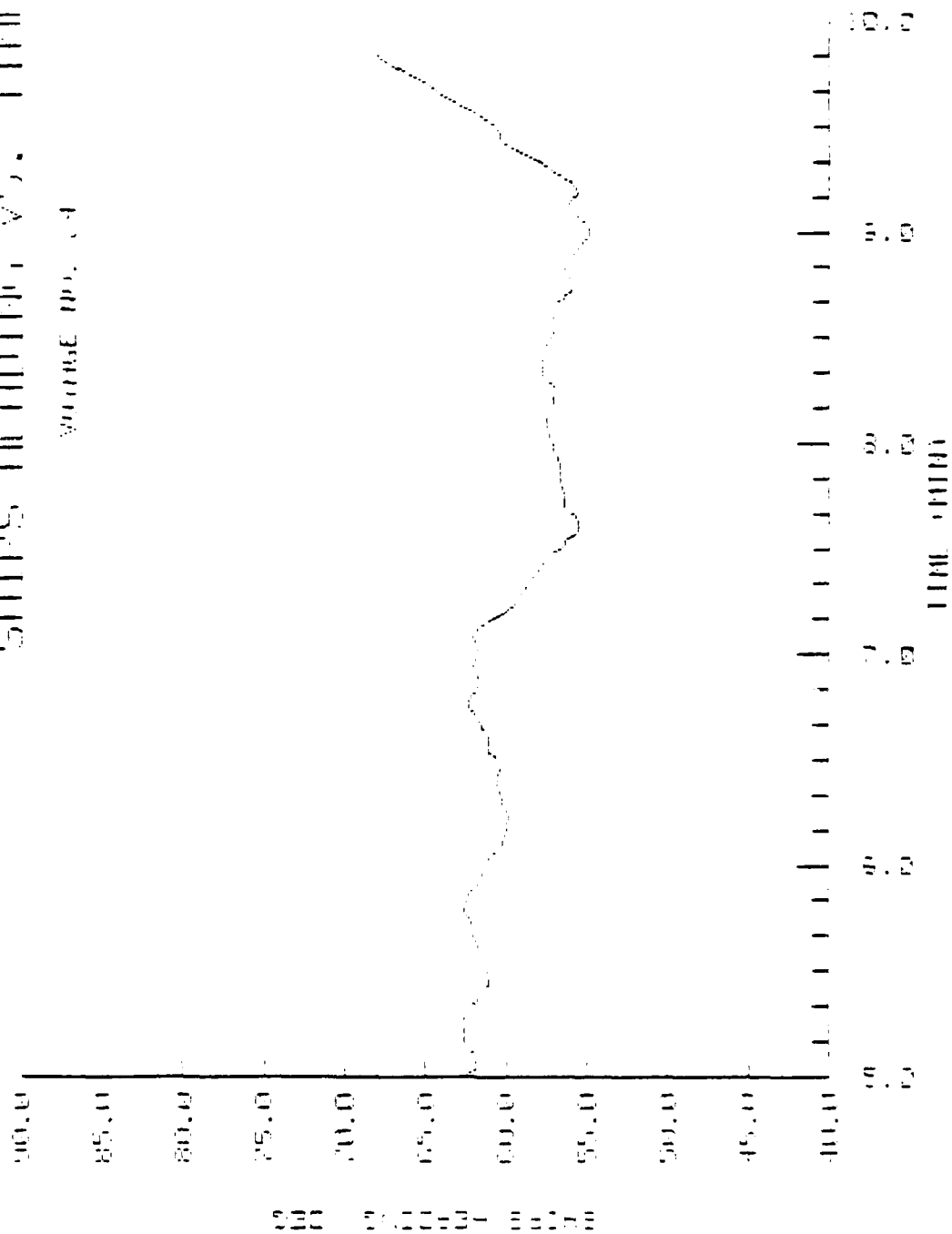


100 1000000- 1000000



# SHIPS IN HULL, V's. III

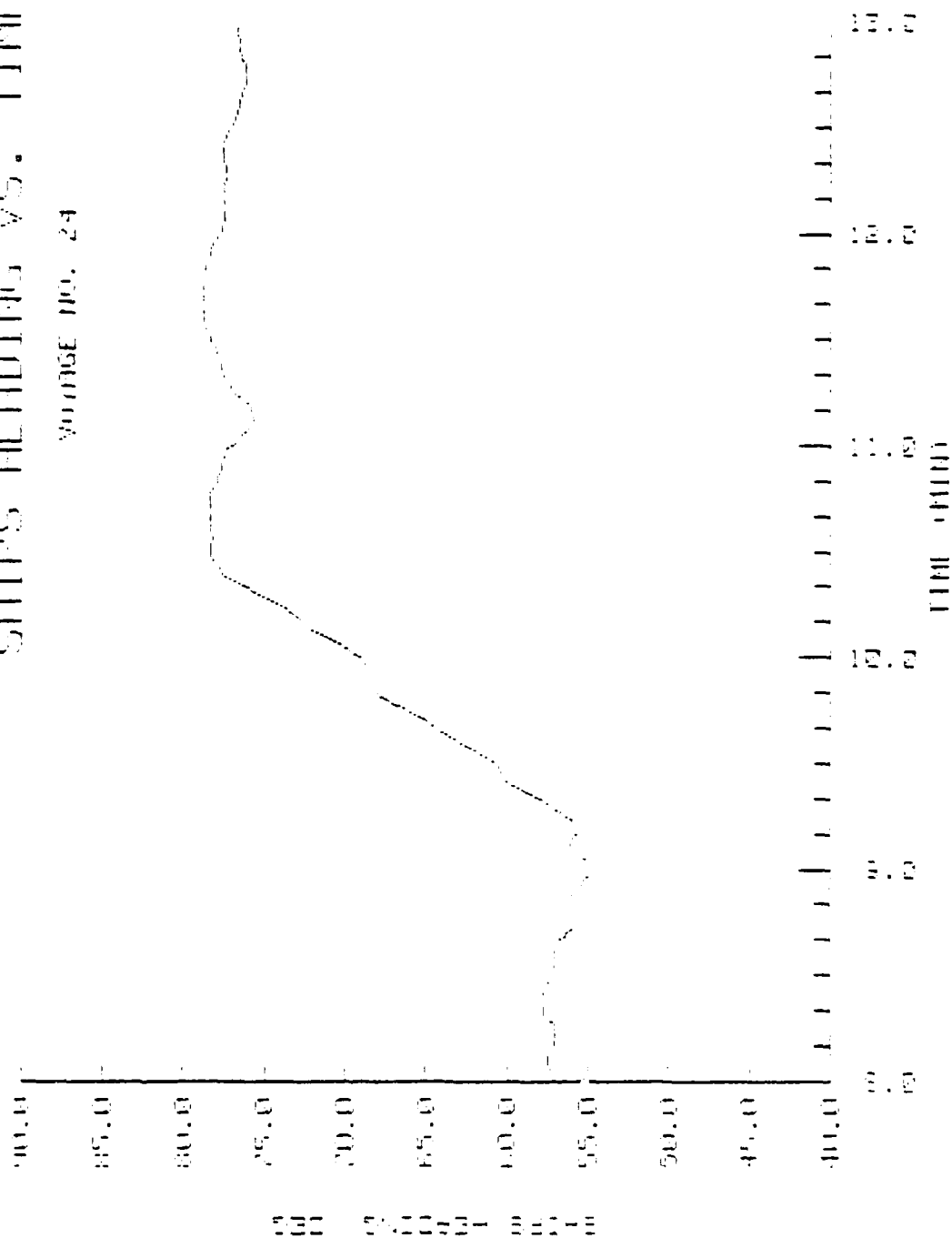
WAVE NO. 14





# SHIPS HEADING VS. TIME

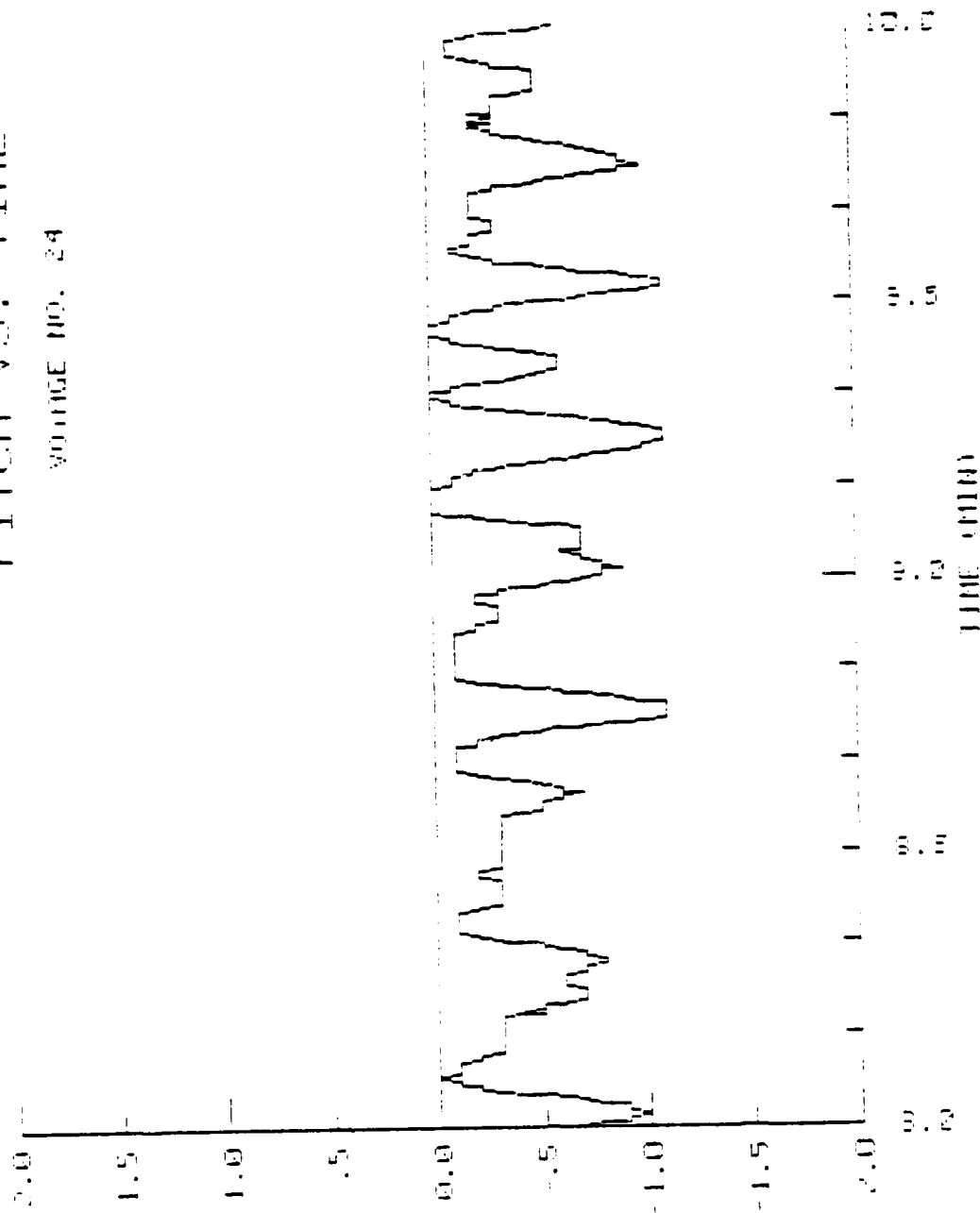
VOYAGE NO. 24





# PITCH VS. TIME

VOLUME NO. 24

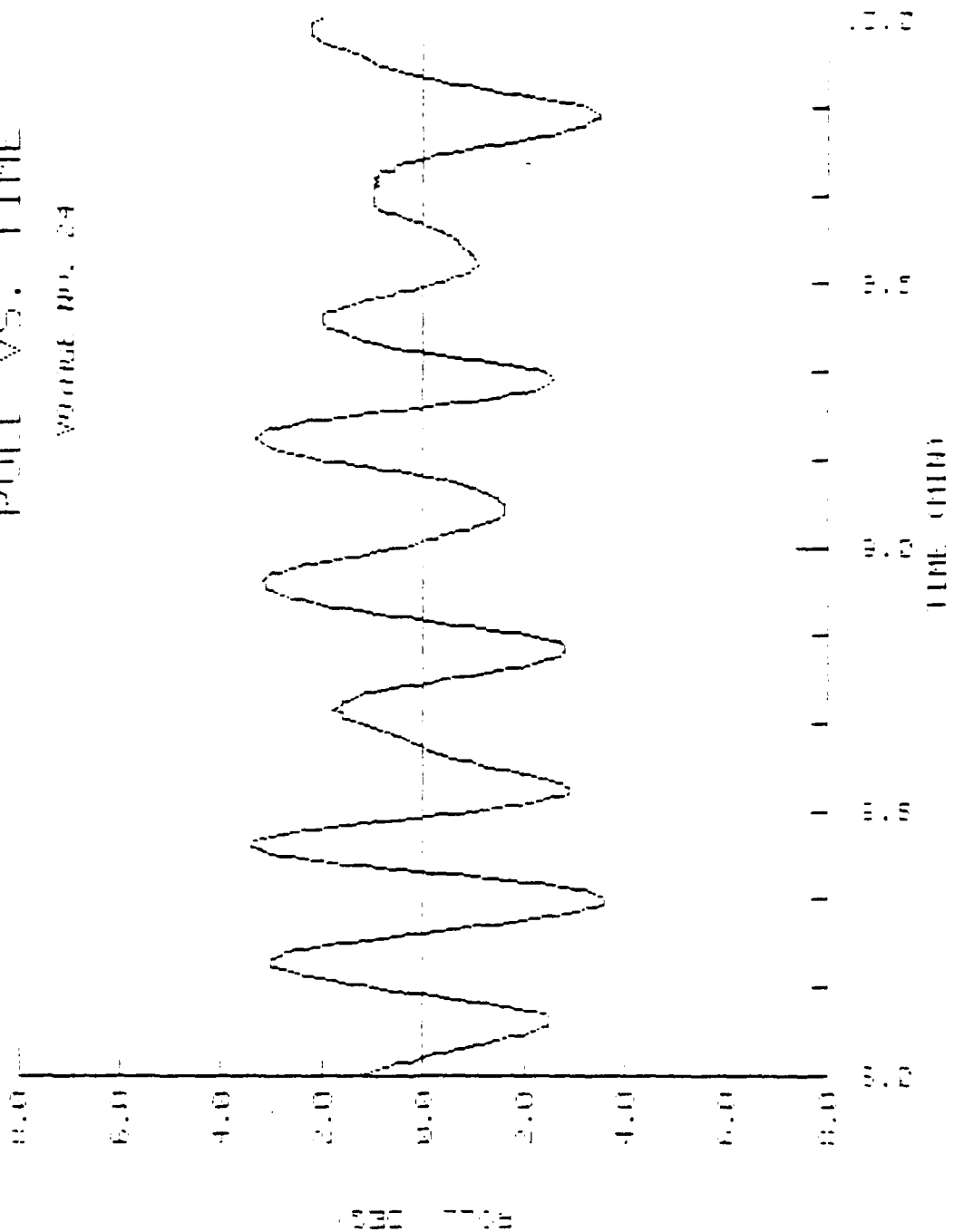


333 11111



# POLL VS. TIME

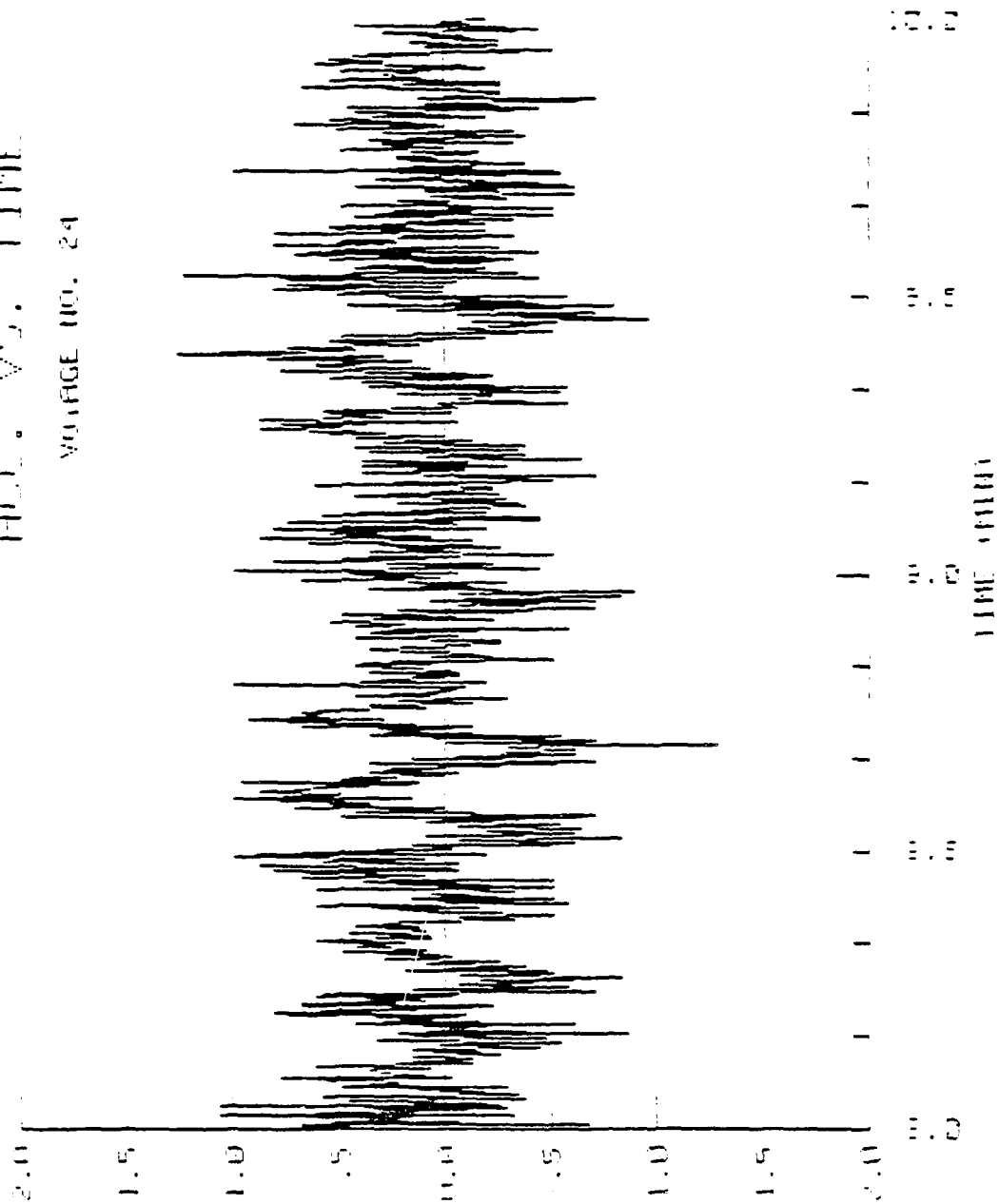
WIND NO. 24





HCL. VS. TIME

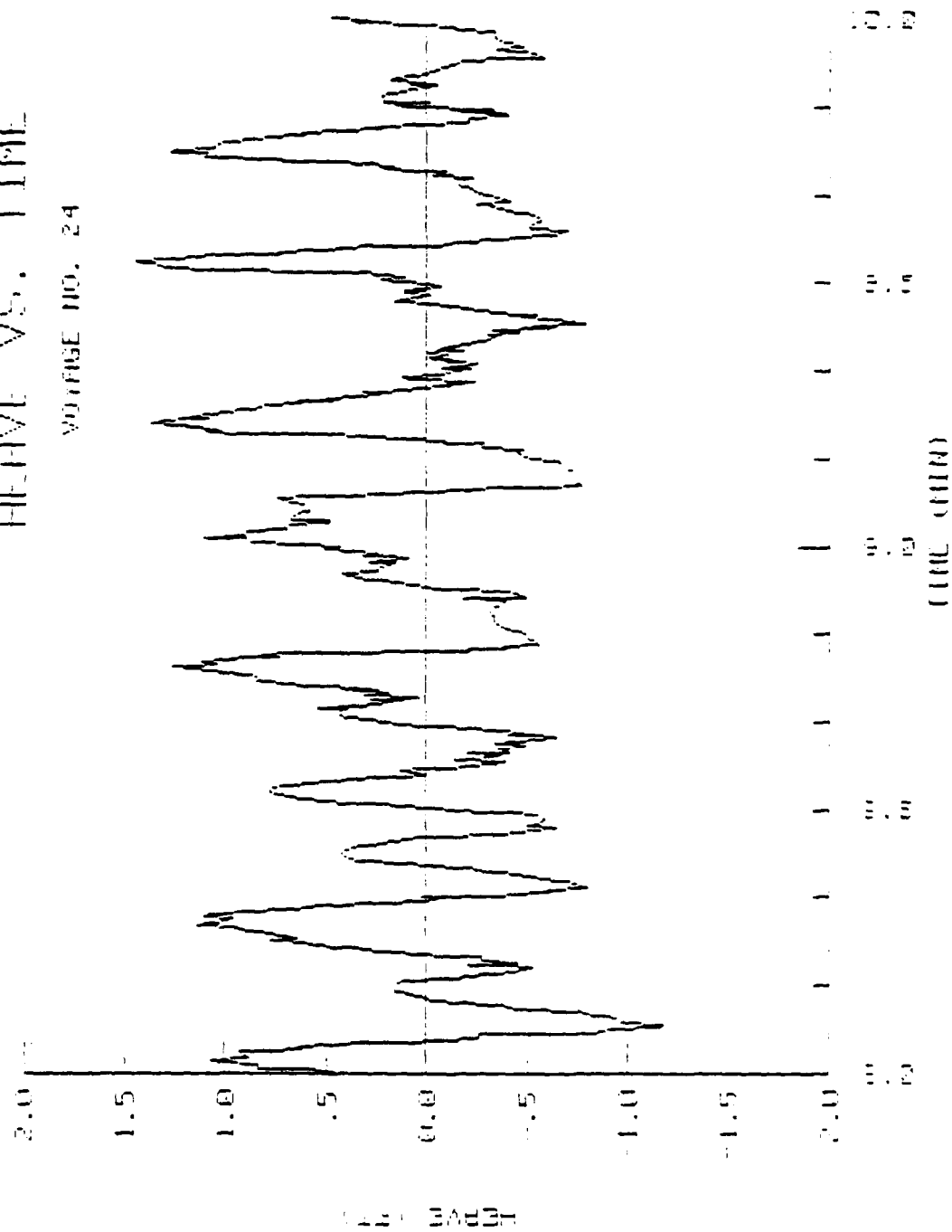
VOLUME NO. 24





# HEAVE VS. TIME

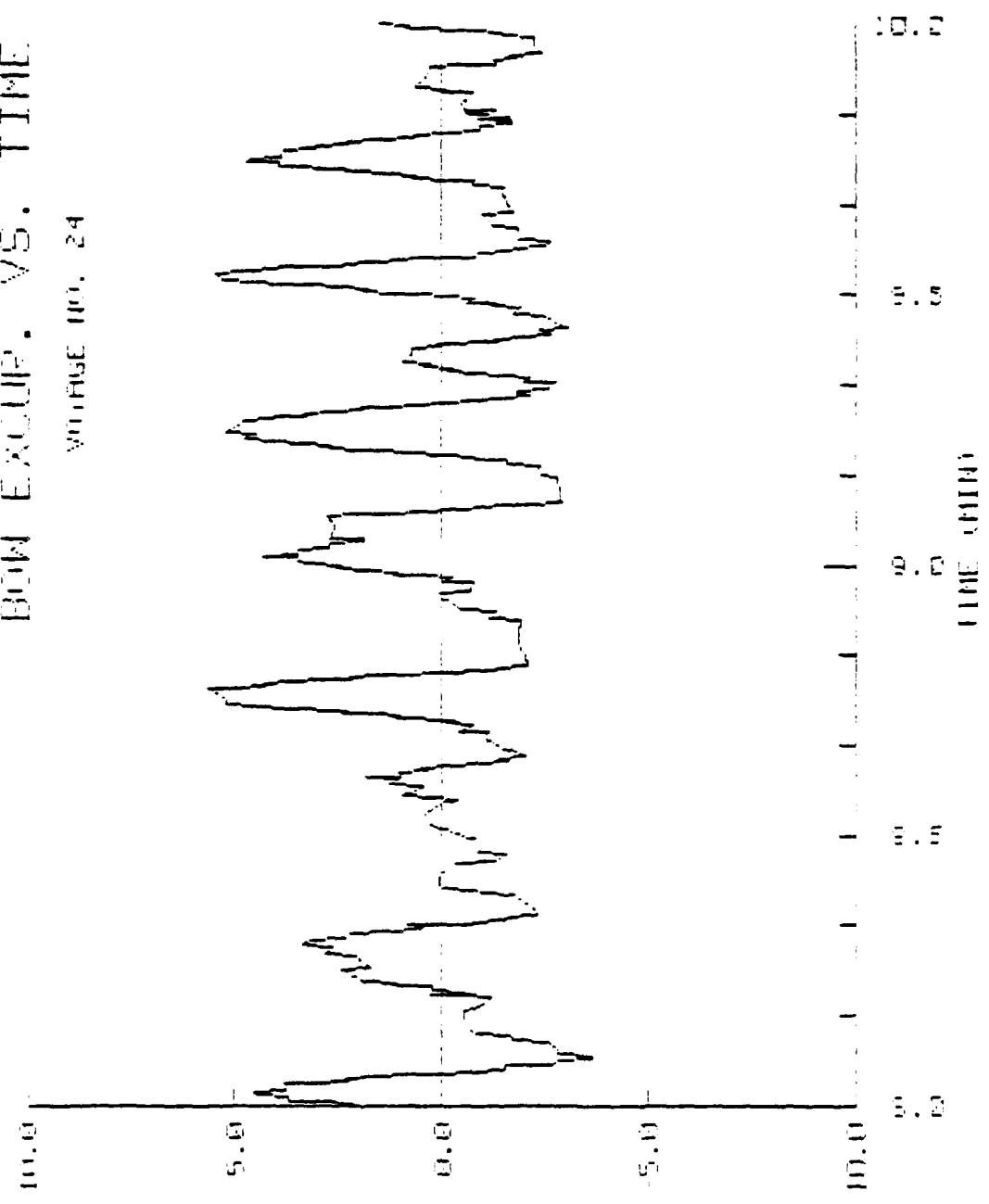
VOYAGE NO. 24





BOW EXCUR. VS. TIME

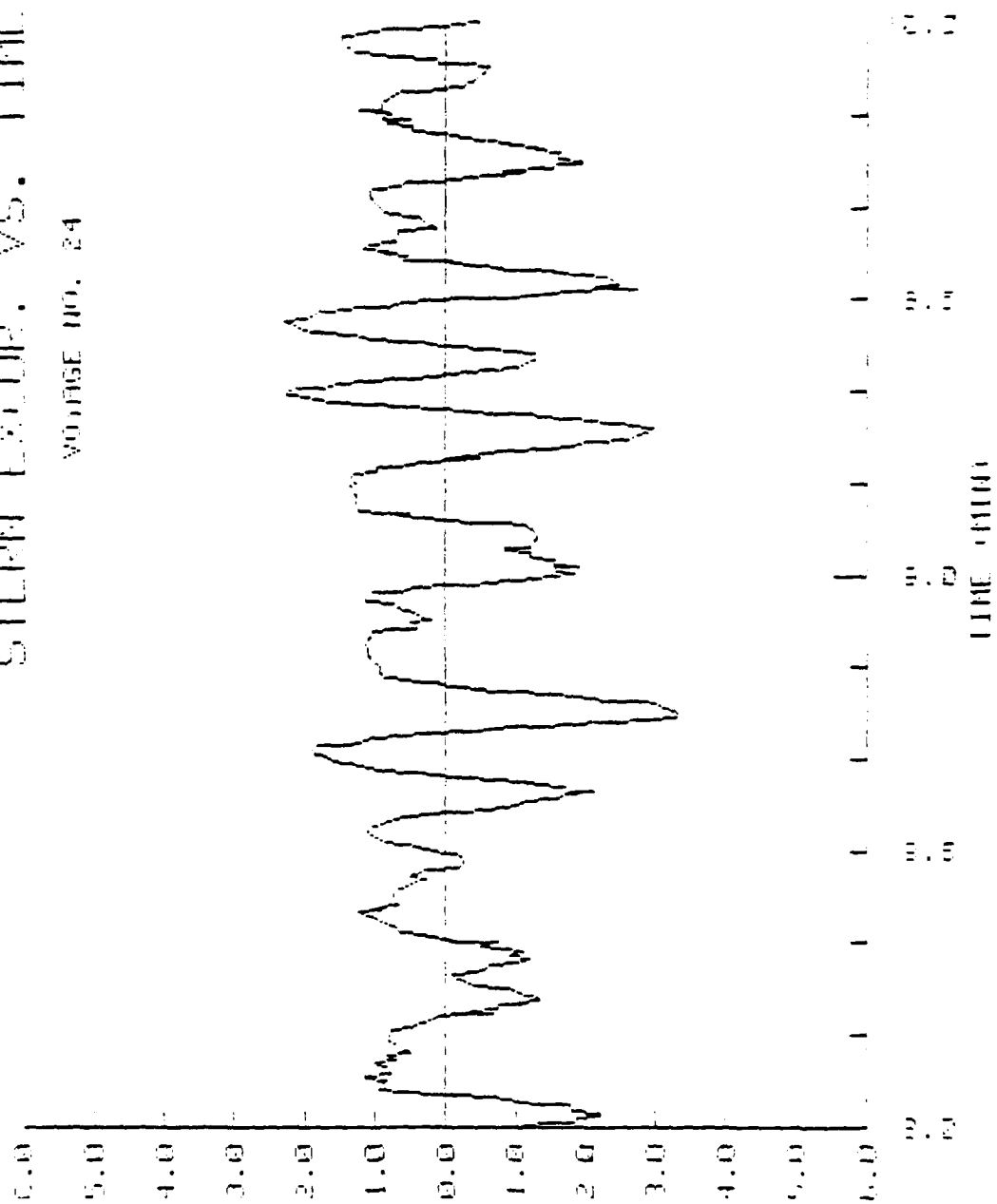
WAVE NO. 24





STEPH EXCUR. VS. TIME

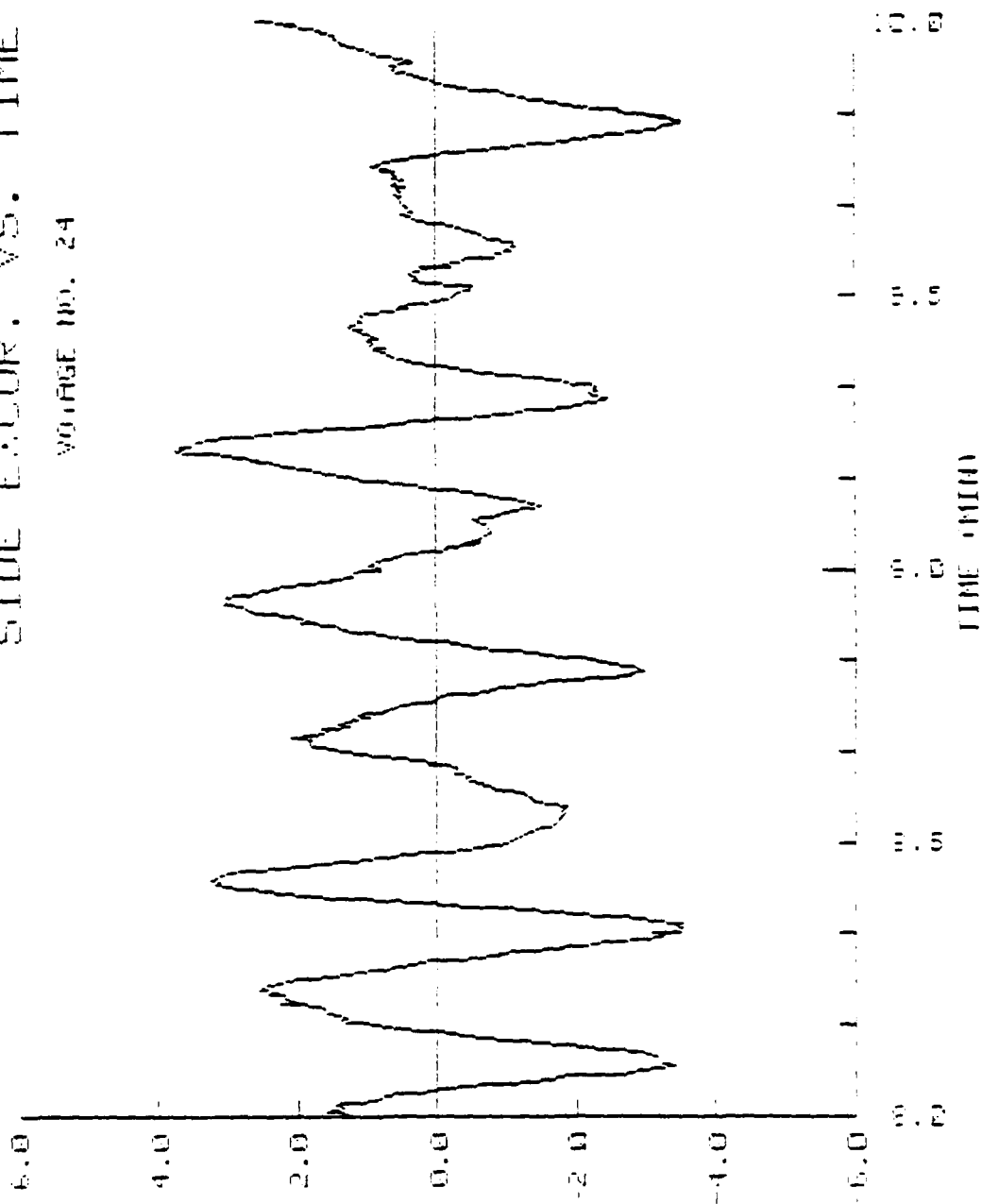
VOLUME NO. 24





# SIDE EXCUR. VS. TIME

VOLUME NO. 24



14-00000-00000



# STATISTICAL SUMMARY

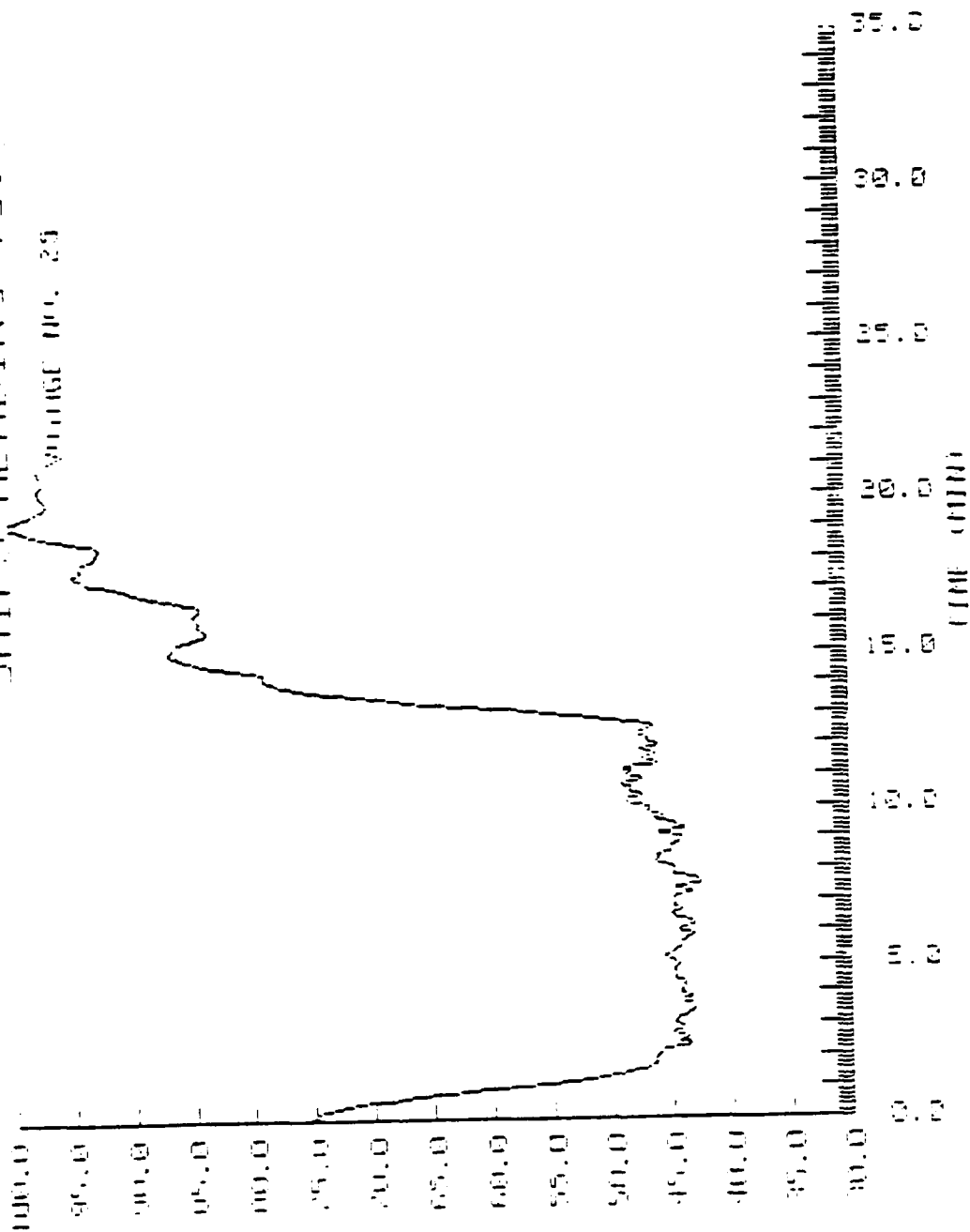
VOYAGE NO. 25

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG.)	-.4	.9	.4	.4
ROLL (DEG.)	-1.0	6.0	2.7	3.0
HEAVE (FT. SEC. SEC.)	.0	1.8	.7	.7
HEAVE (FT.)	.1	1.8	.7	.8
ROLL (COUP. (FT.)	.1	5.9	2.1	2.5
HEAVE (COUP. (FT.)	.1	3.0	1.3	1.4
ROLL (COUP. (FT.)	.1	5.2	2.1	2.4



# SHIPS HEADING VS. TIME

WAVE NO. 29

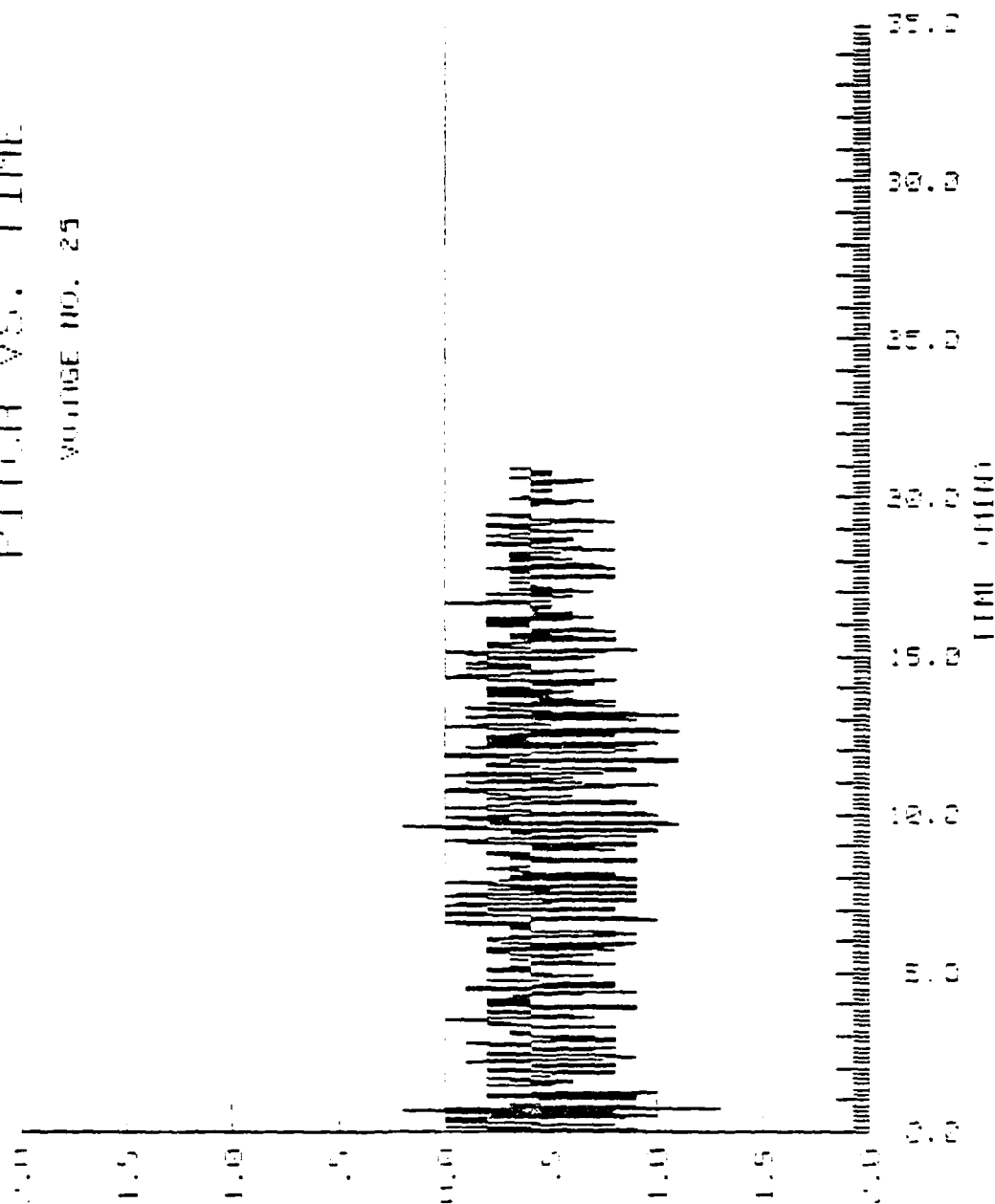


SHIPS HEADING VS. TIME



# PITCH VS. TIME

VOLUME NO. 25





# ROLL VS. TIME

VOLUME NO. 25

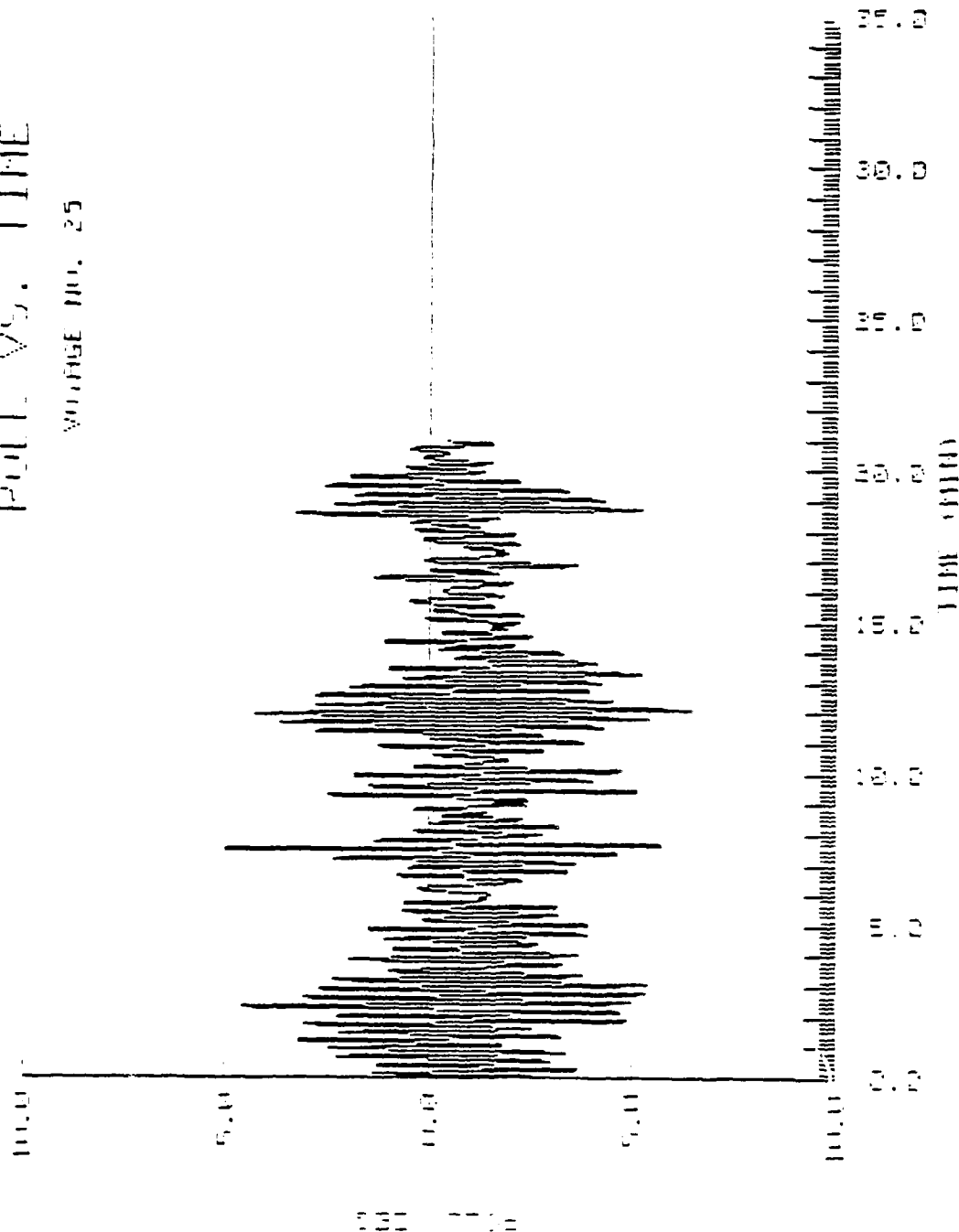
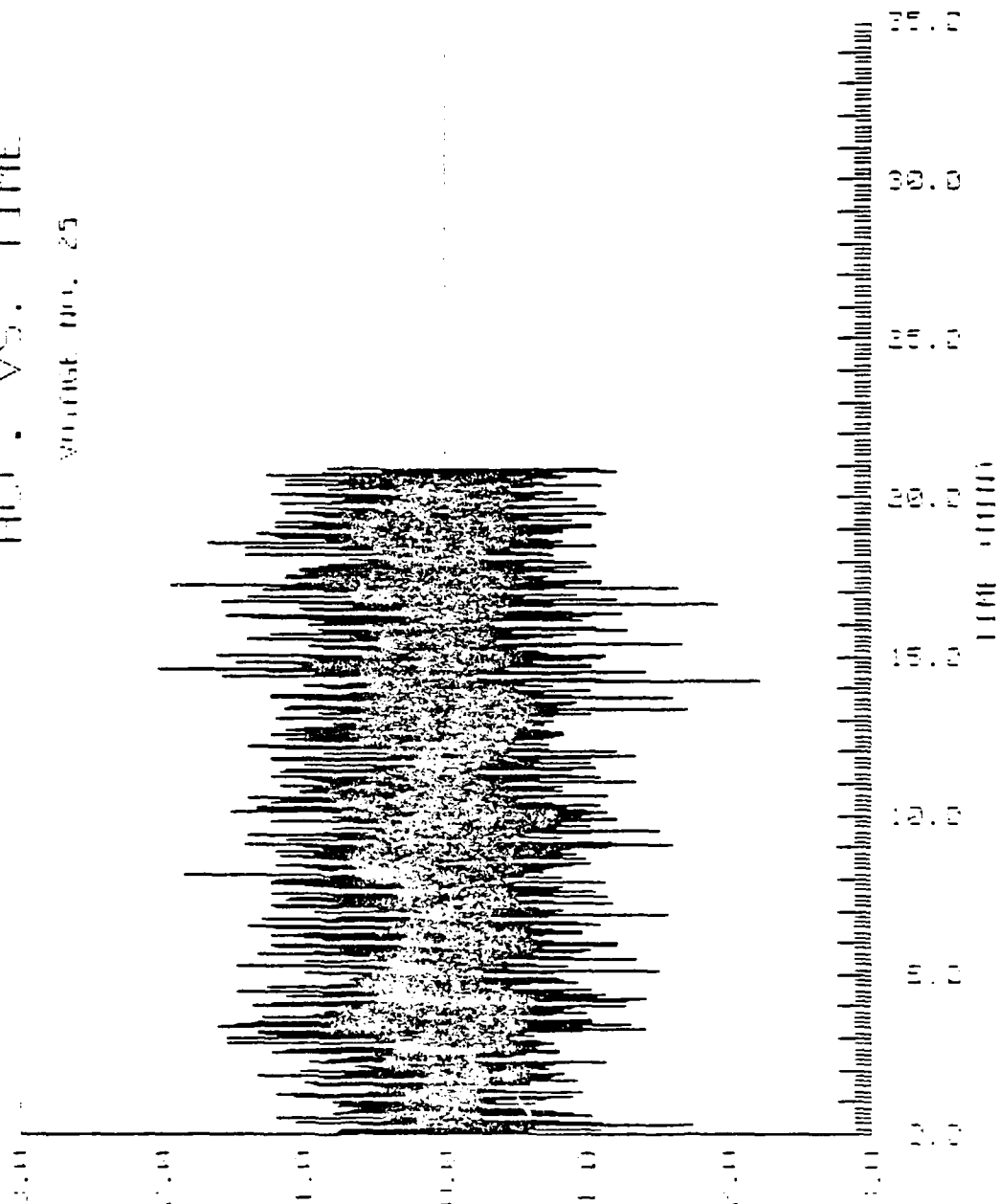




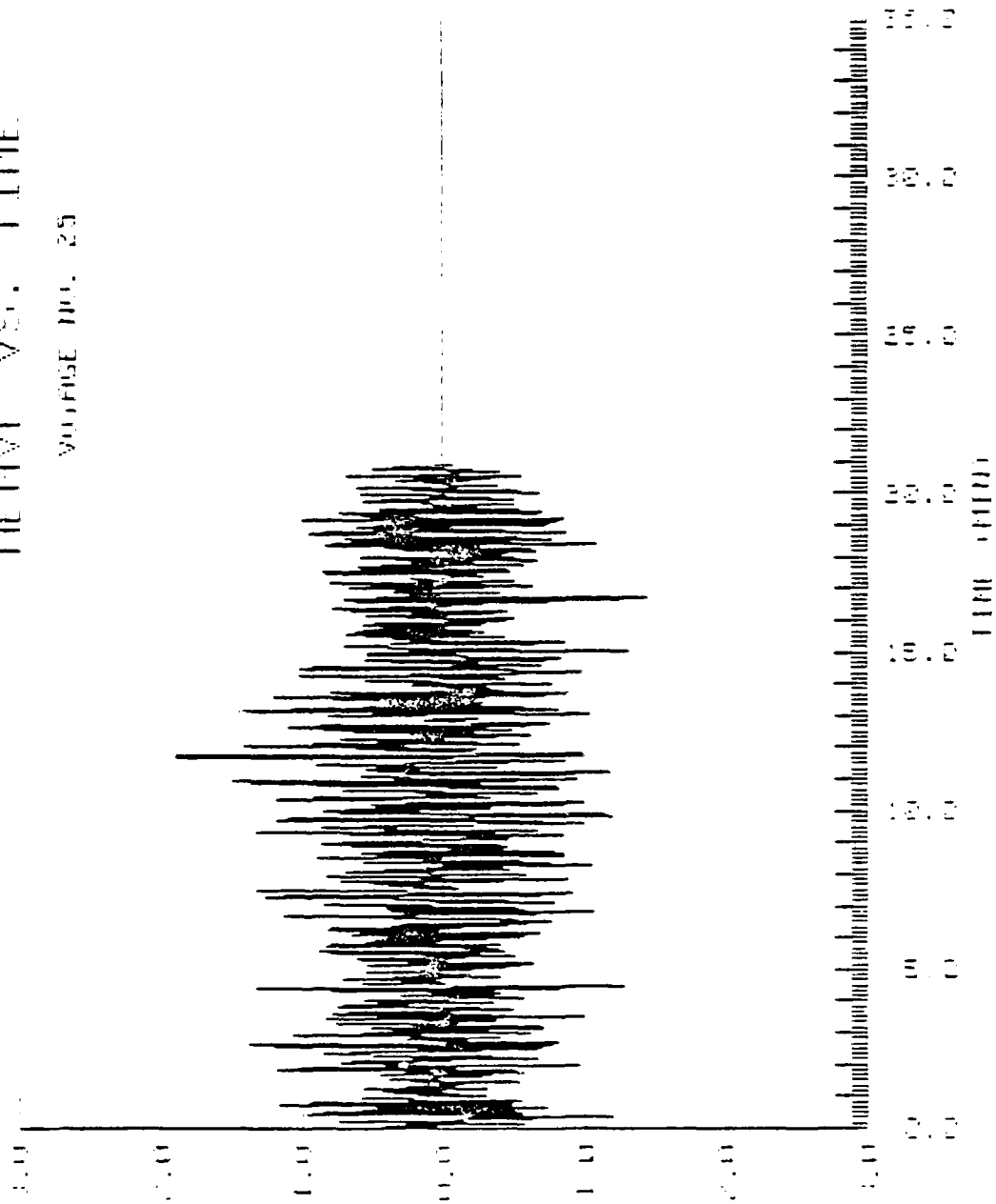
FIG. 1. VS. TIME  
 VOLUME NO. 25





# HELM VEG. TIME

VOYAGE NO. 25

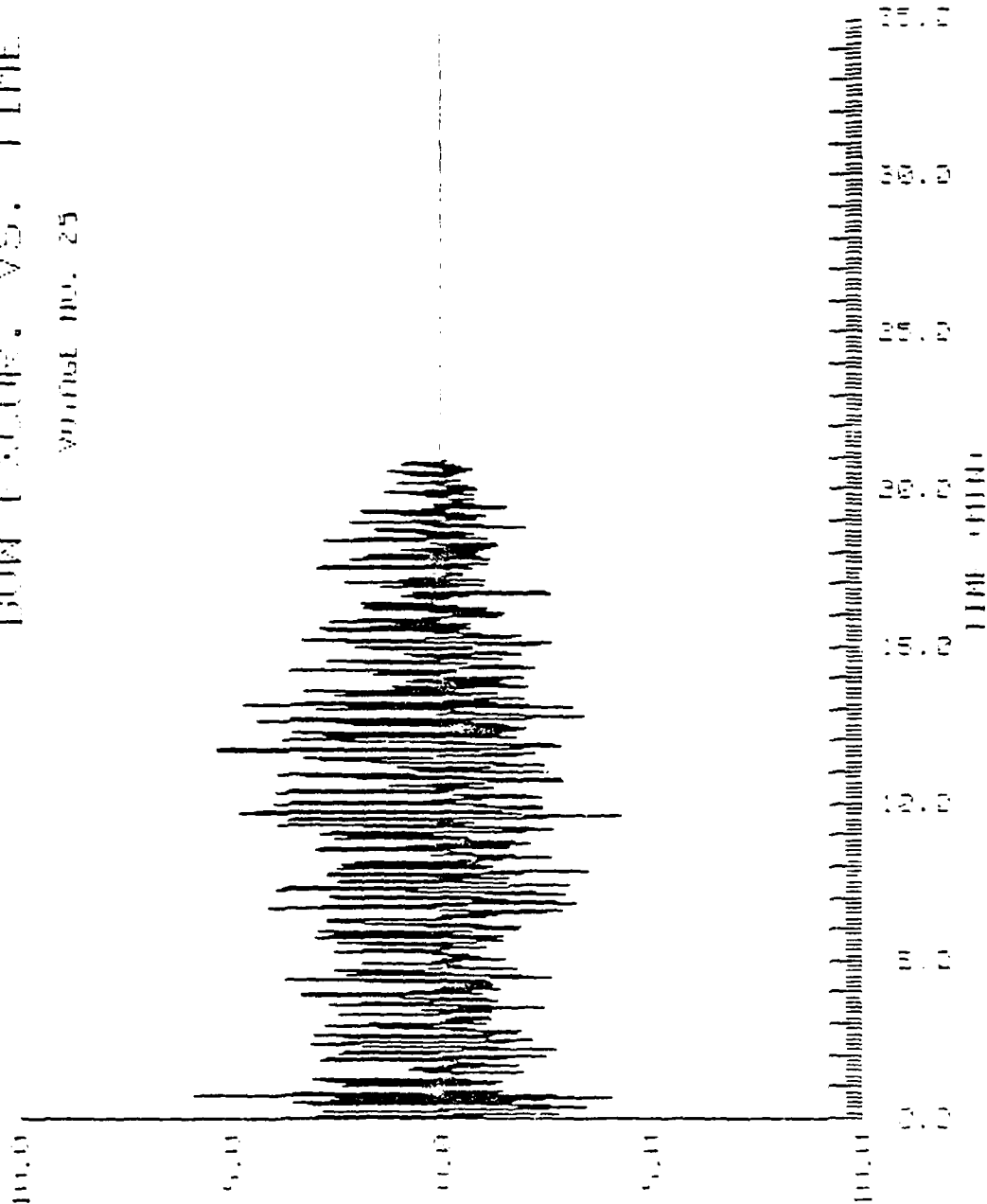


11-11-11



# BOB F. SCULP. VS. TIME

Volume No. 25





AD-A098 984

TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

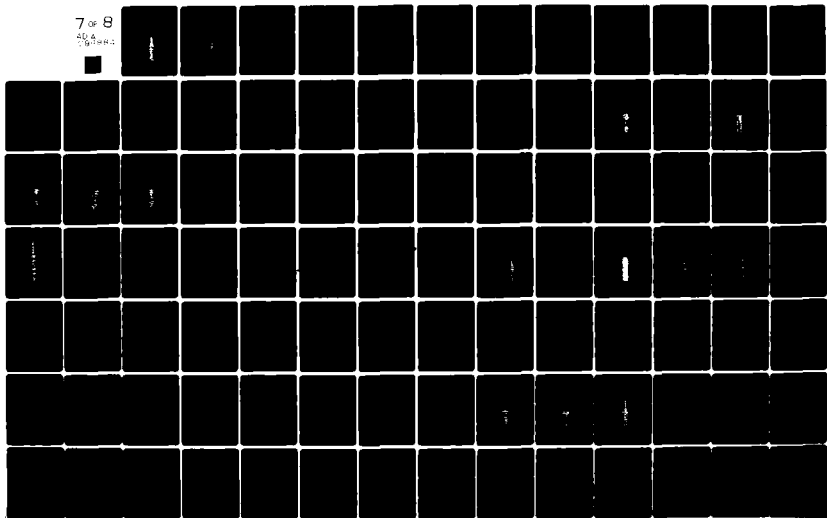
UNCLASSIFIED

TETRA-T-3925-APP-A(1)

NL

7 of 8

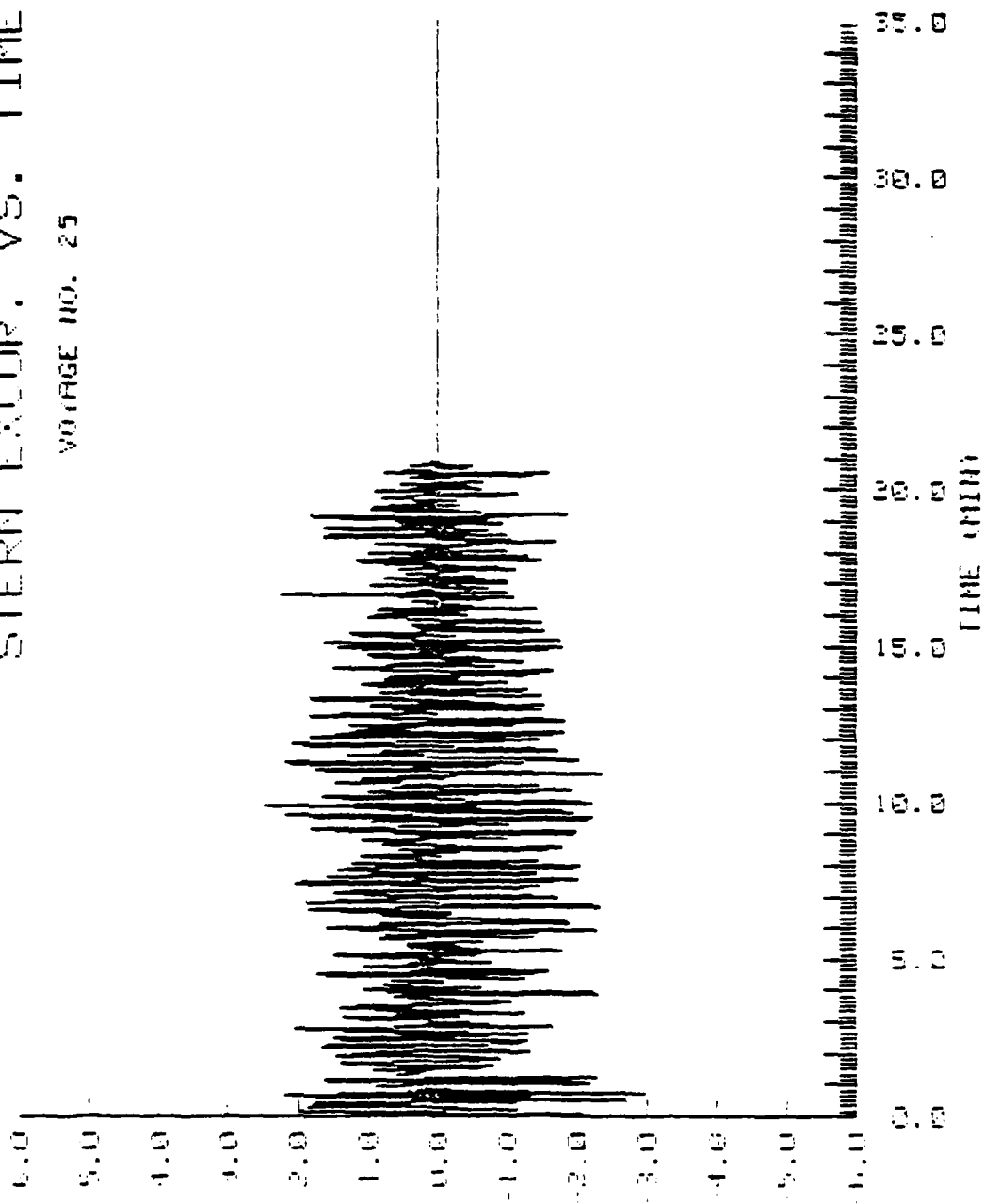
404  
CUBH-1





# STERN EXCUR. VS. TIME

VOLTAGE NO. 25

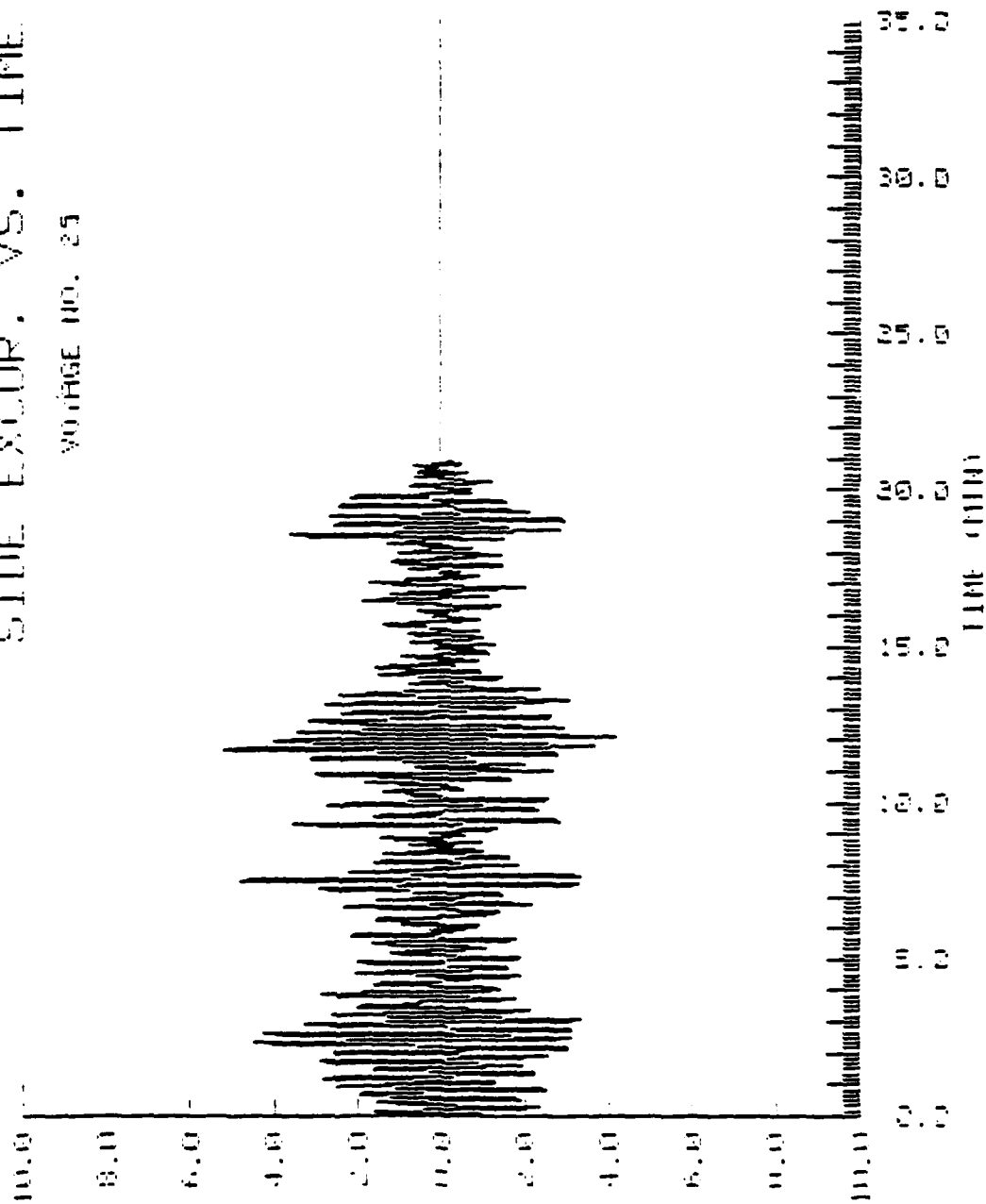


11 0711.3 00013



# SIDE EXCUR. VS. TIME

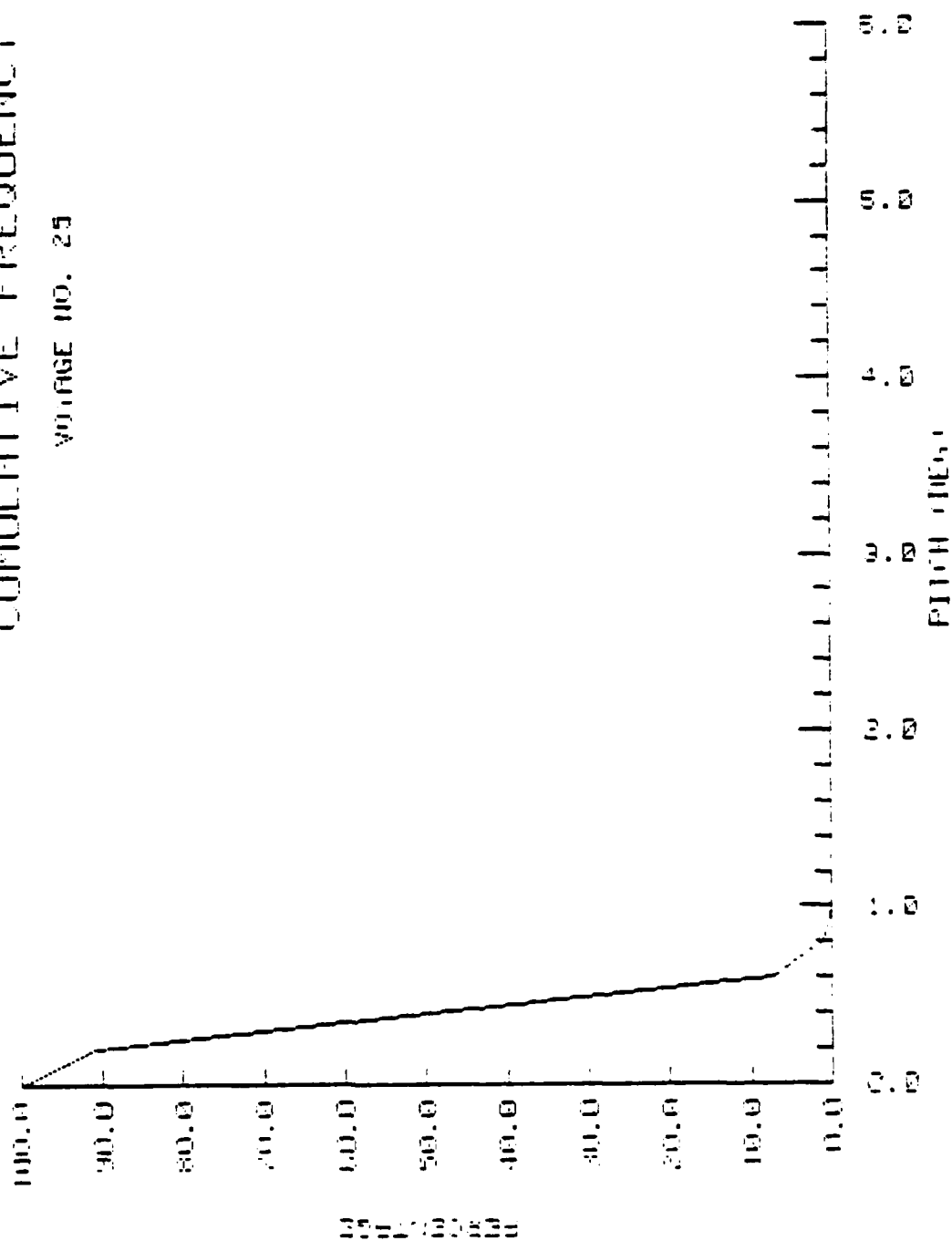
WAVE NO. 25





# CUMULATIVE FREQUENCY

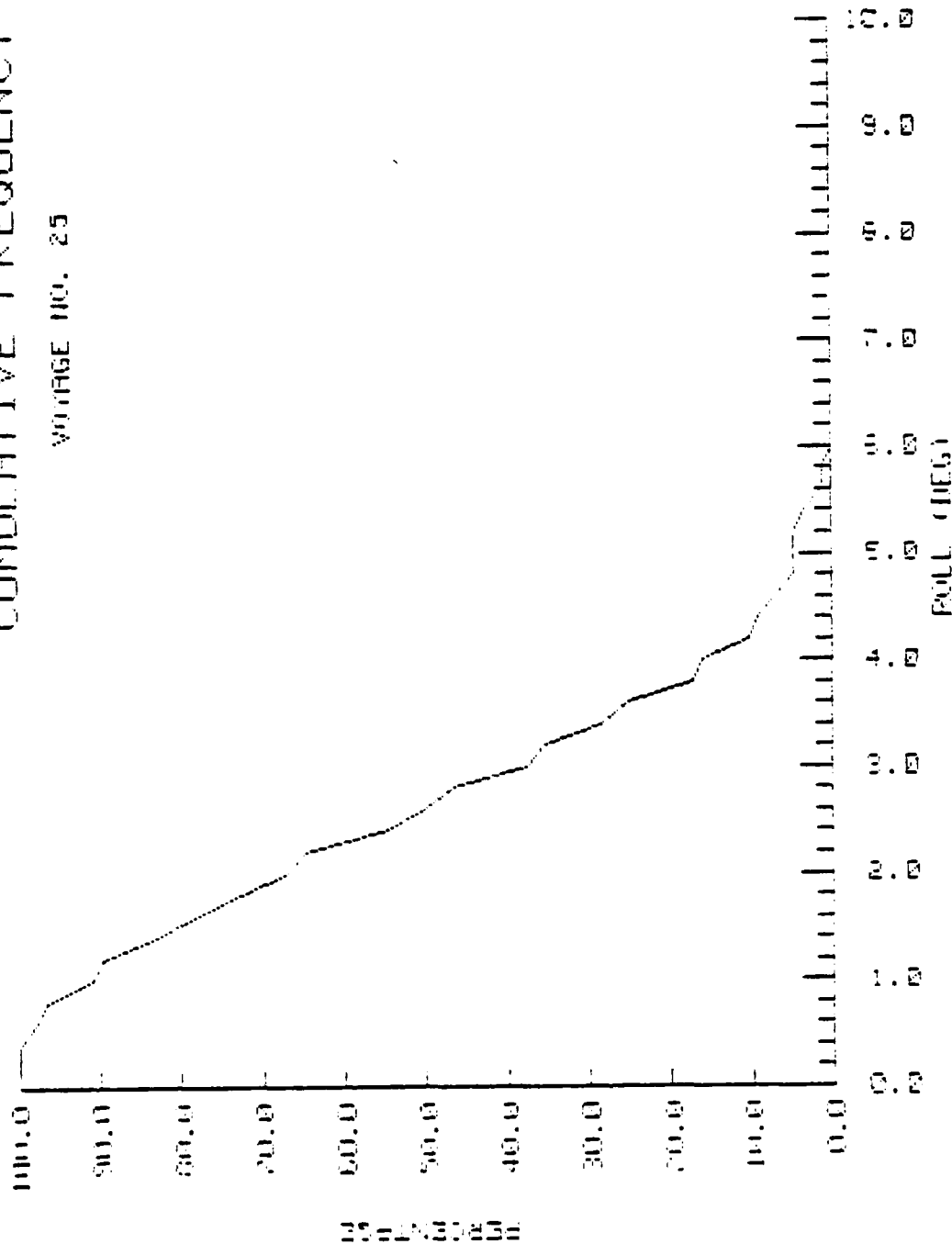
VOLAGE NO. 25





# CUMULATIVE FREQUENCY

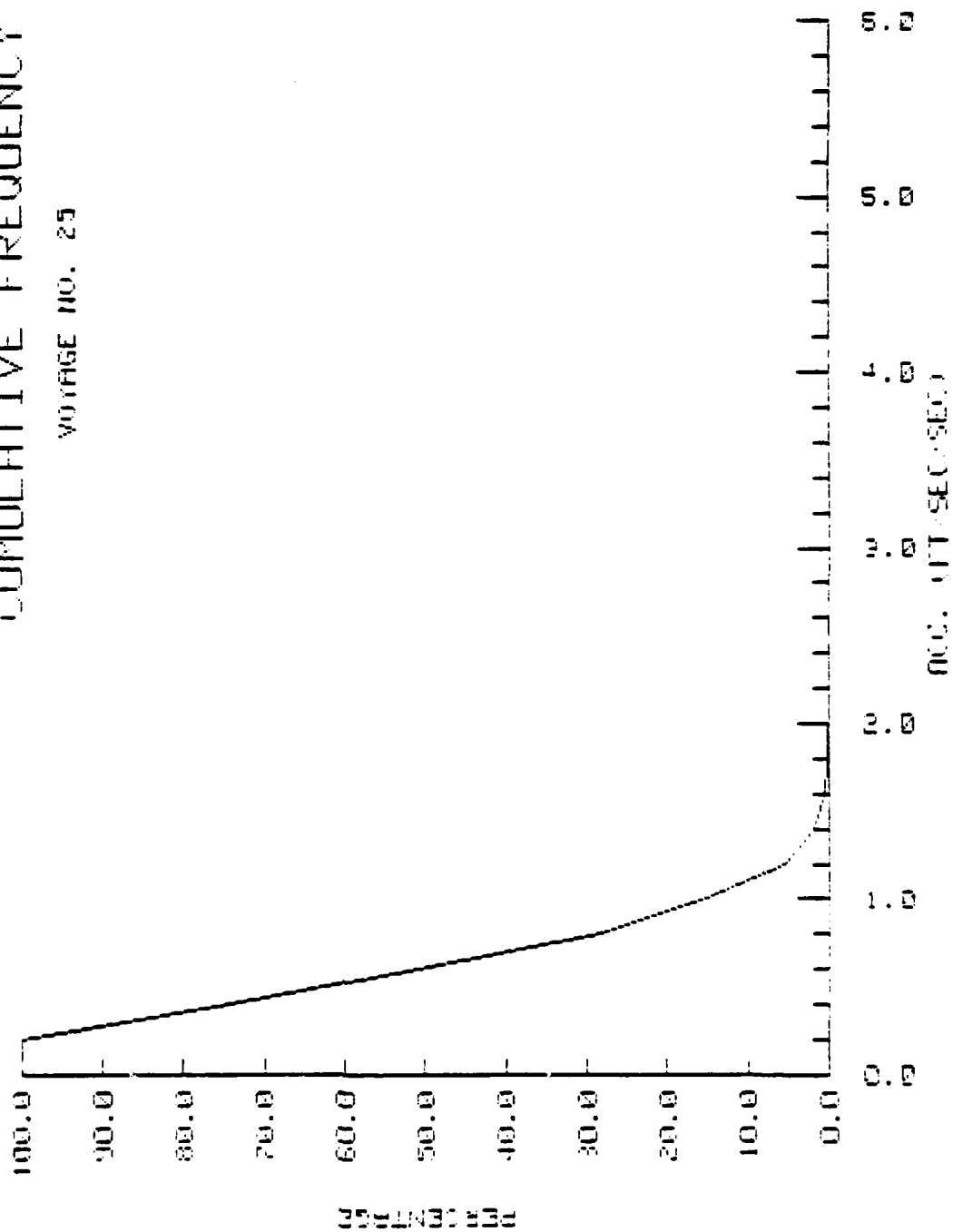
VOLUME NO. 25





# CUMULATIVE FREQUENCY

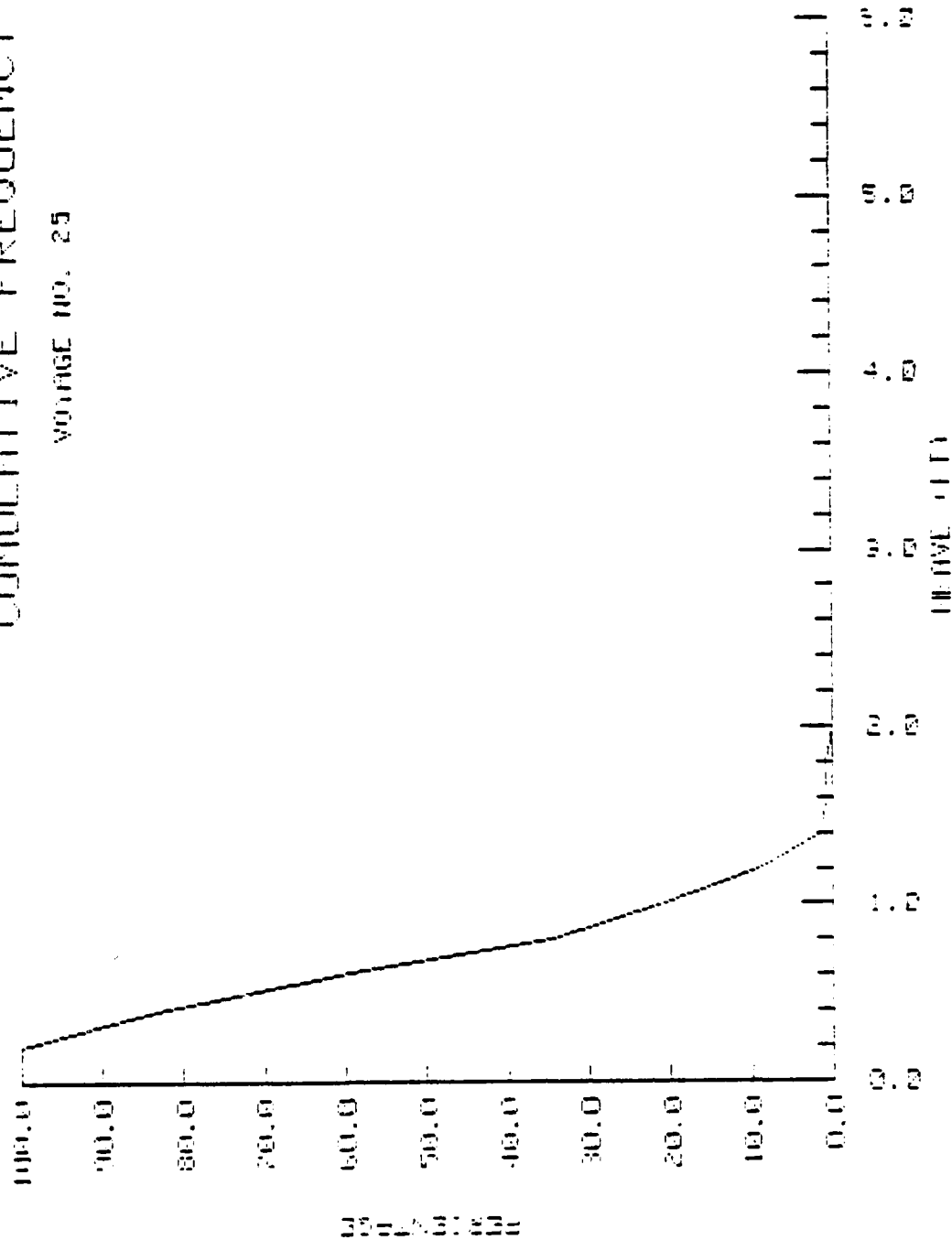
VOLTAGE NO. 25





# CUMULATIVE FREQUENCY

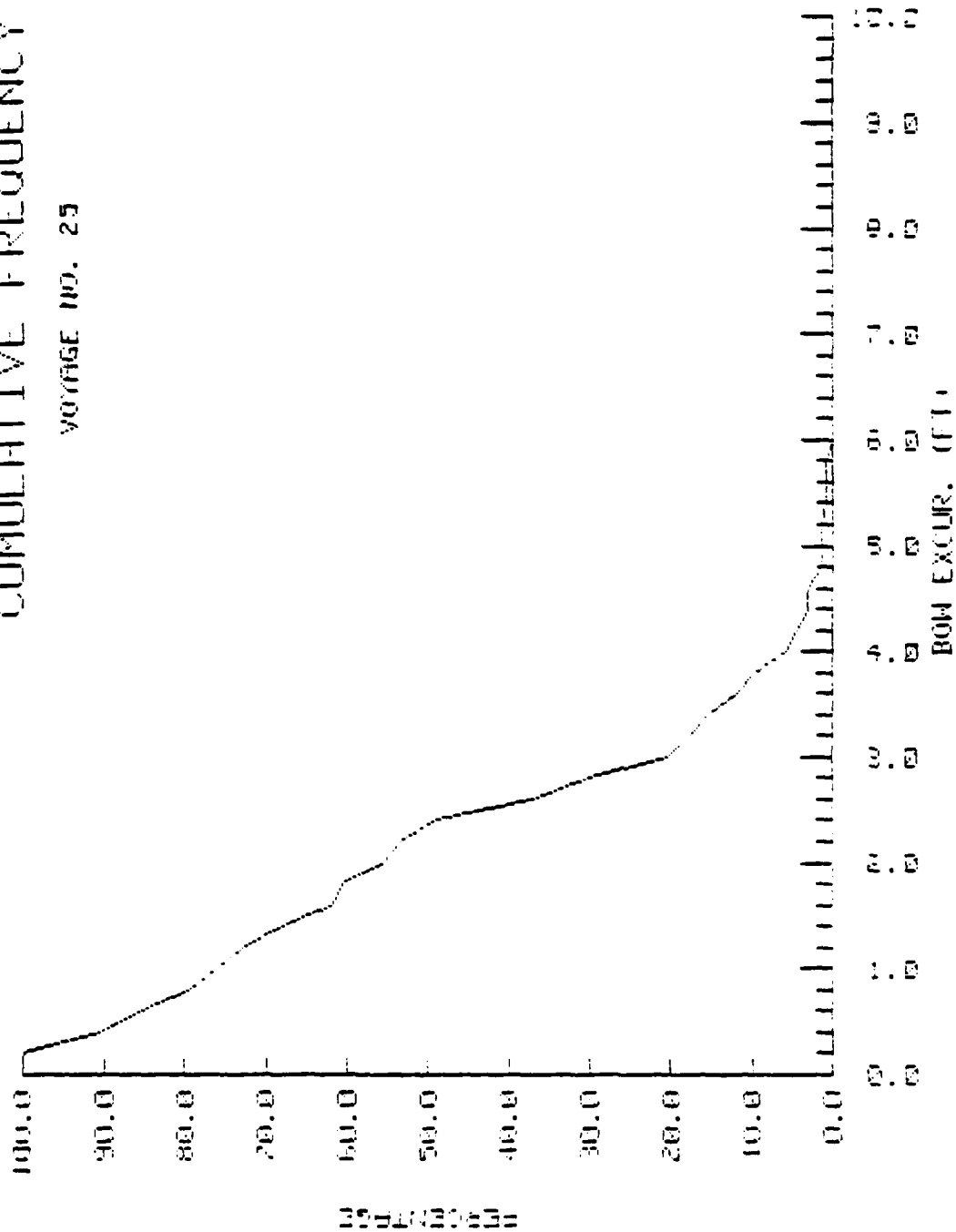
VOLUME NO. 25





# CUMULATIVE FREQUENCY

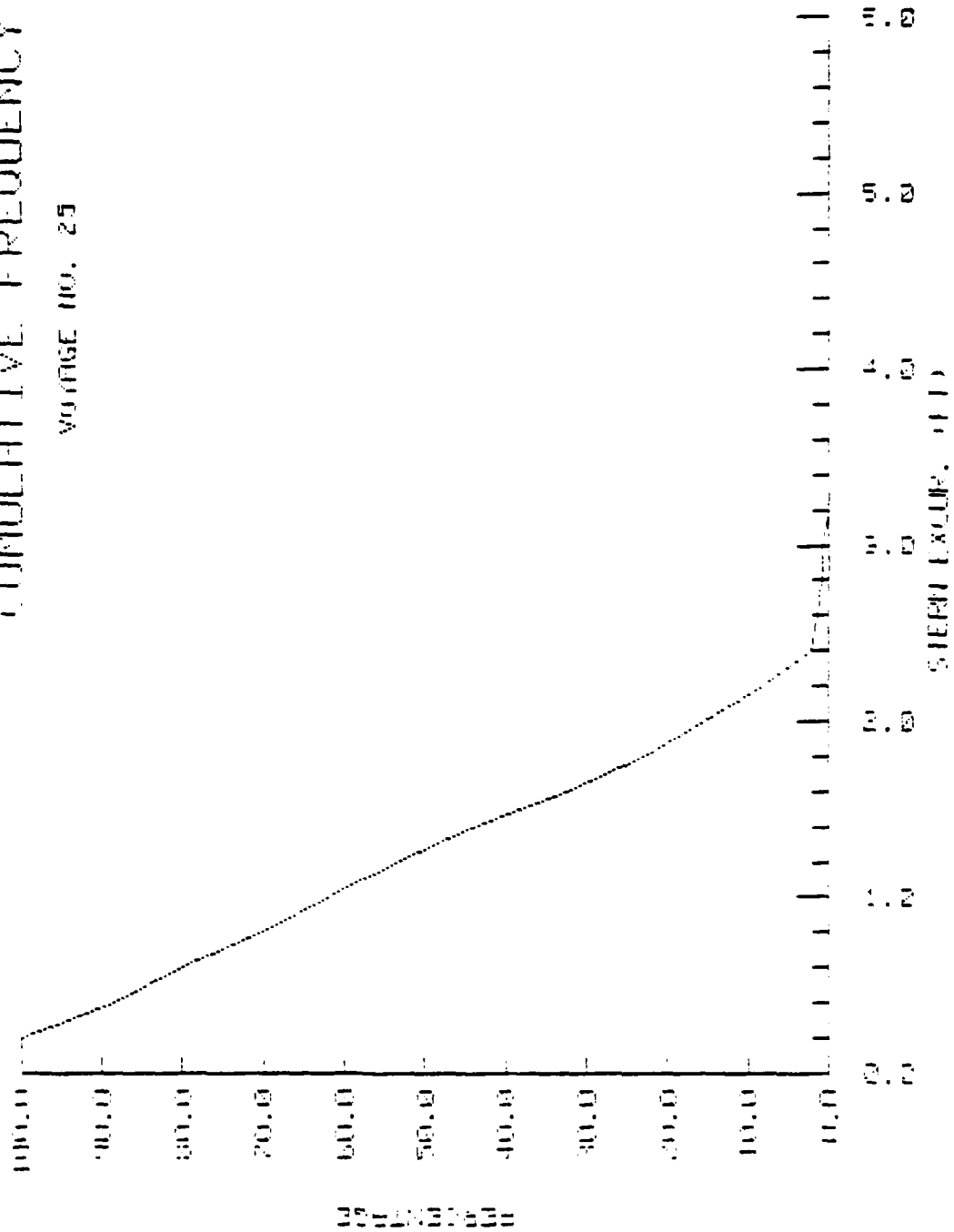
VOLUME NO. 25





# CUMULATIVE FREQUENCY

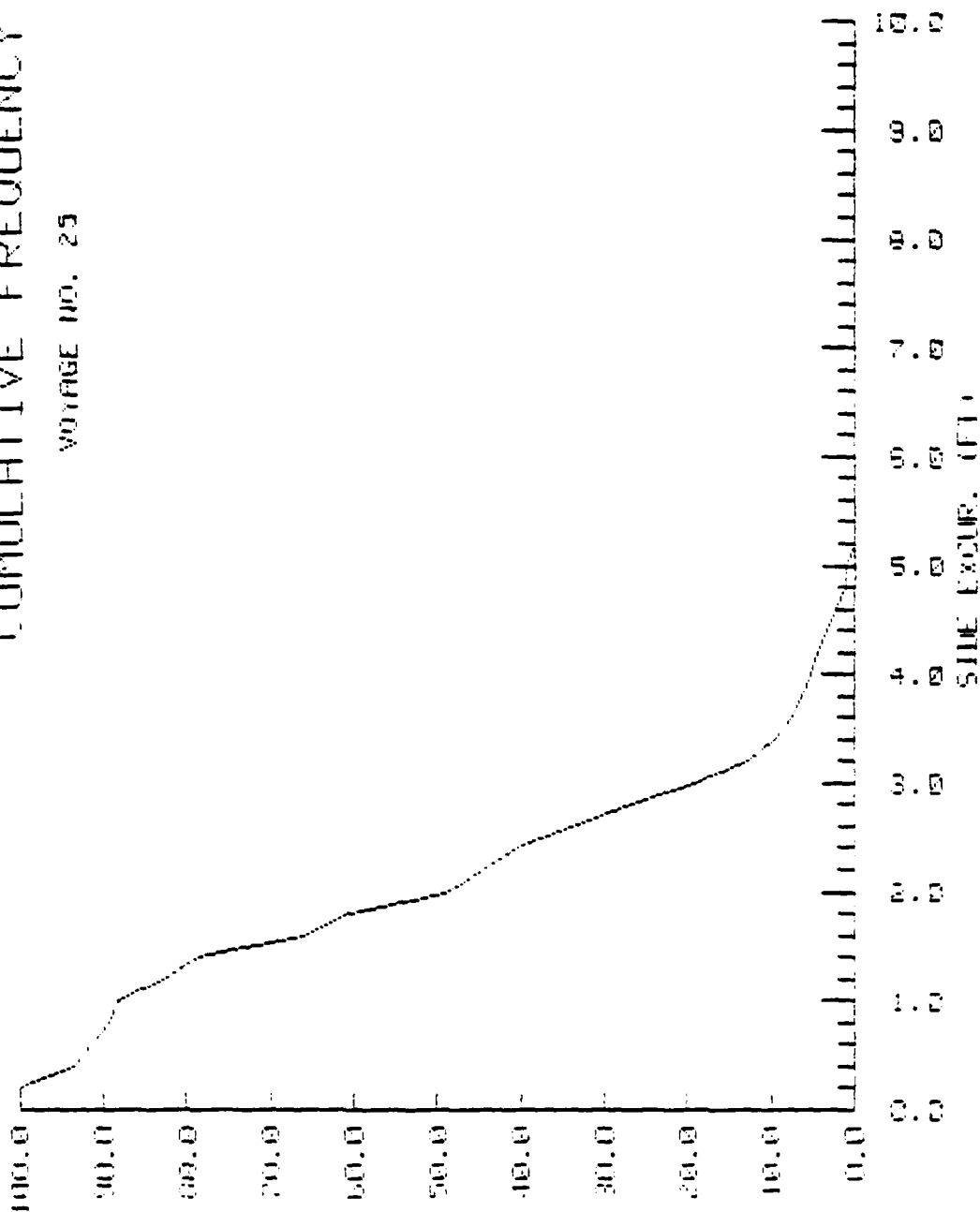
VOLUME NO. 25





# CUMULATIVE FREQUENCY

VOYAGE NO. 25

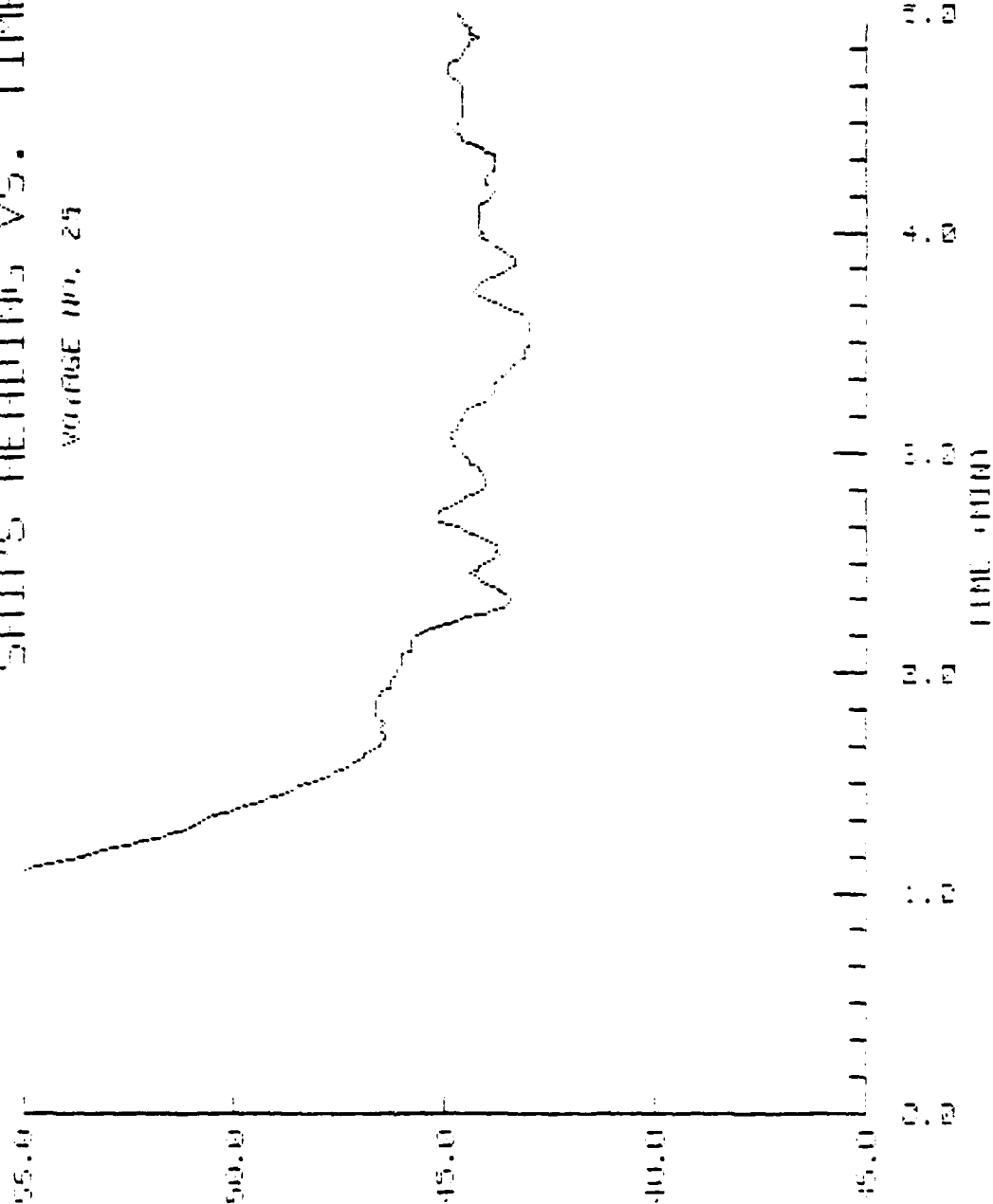


SHIP EXCUR. (HRS)



# SHIP'S HEADING VS. TIME

VOYAGE NO. 27

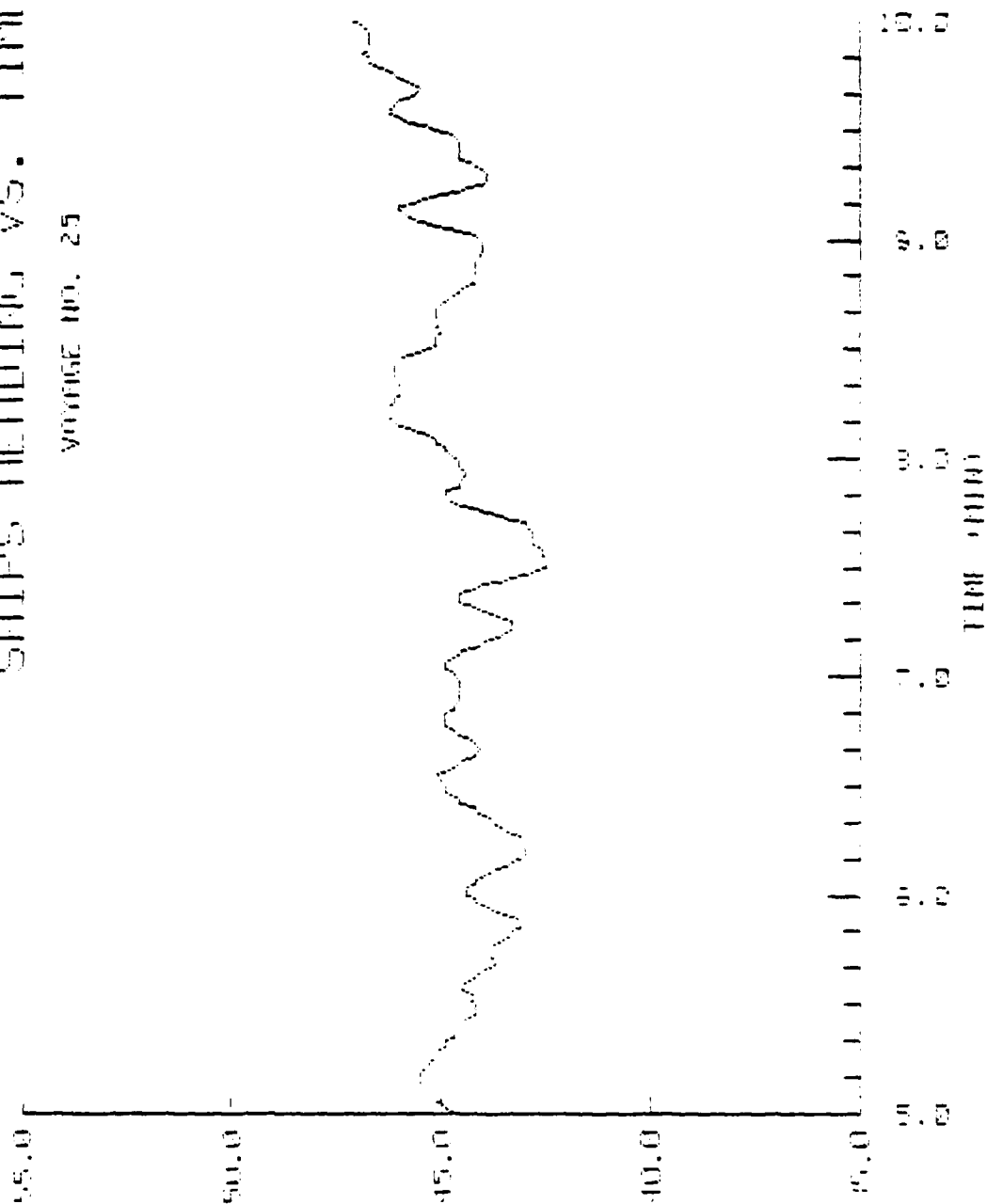


64.123 50.17834 52.746



## SHIPS BEHIND VS. THE

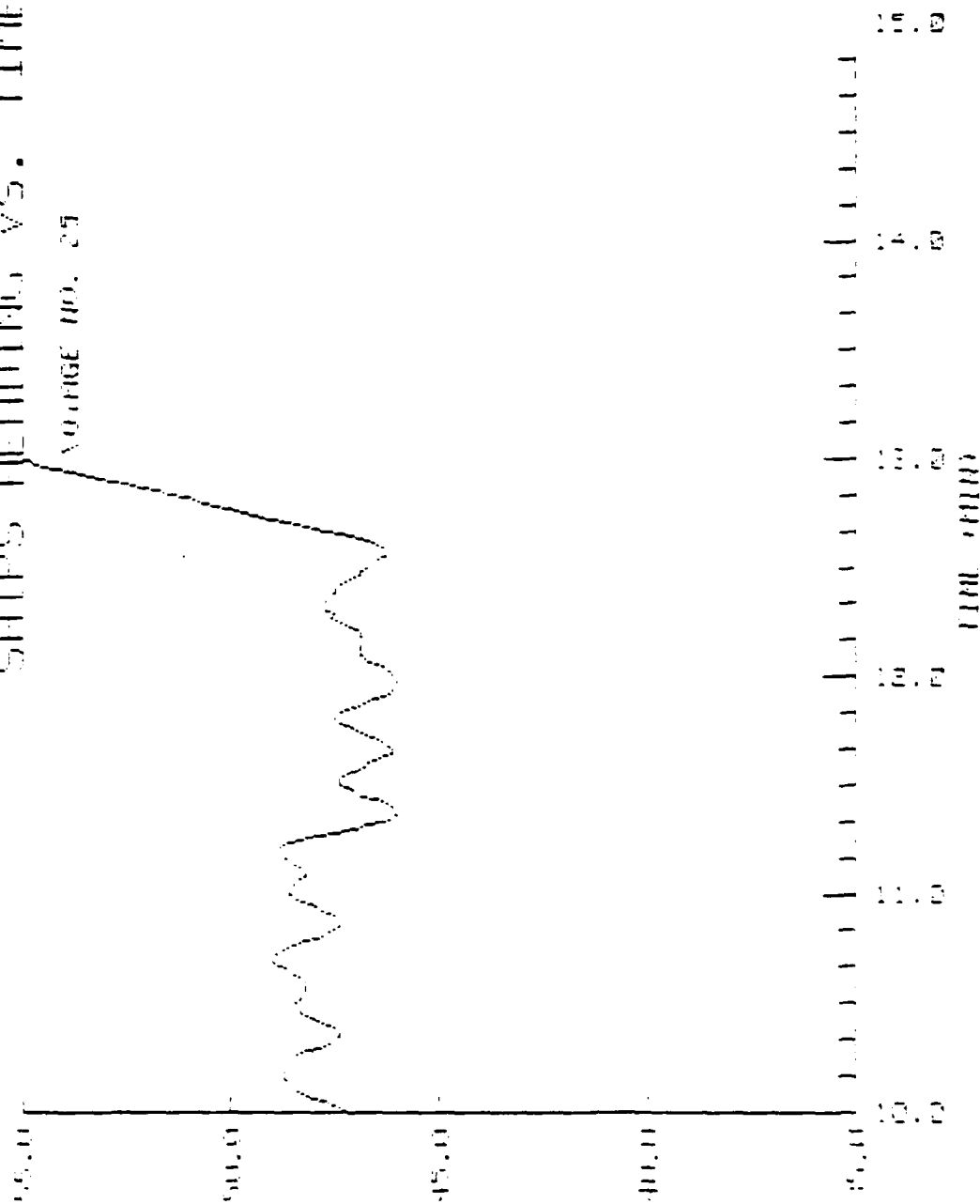
page 10, 25





# SHIPS HEADING VS. TIME

VOYAGE NO. 27

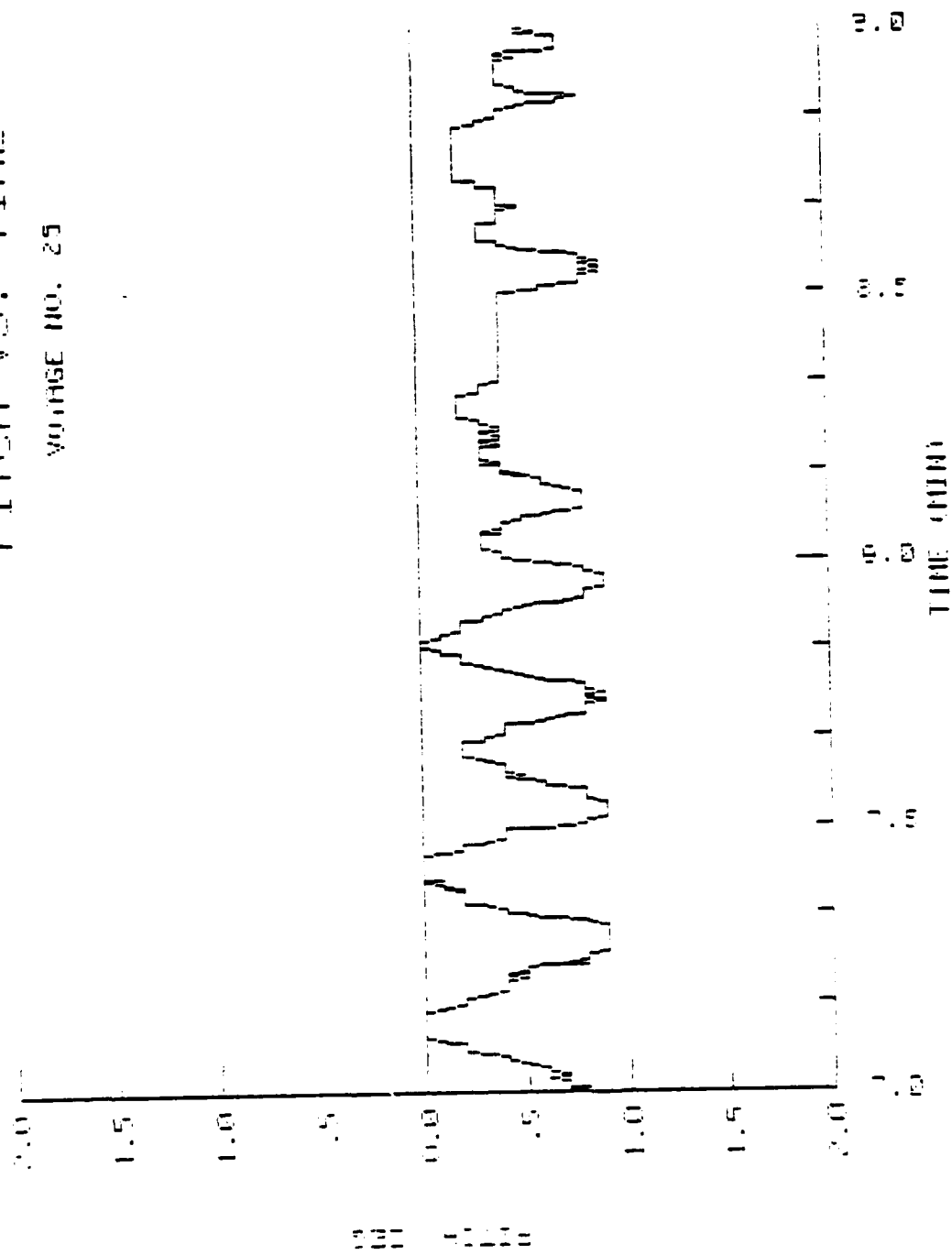


100-5000-3-33-1E



# PITCH VS. TIME

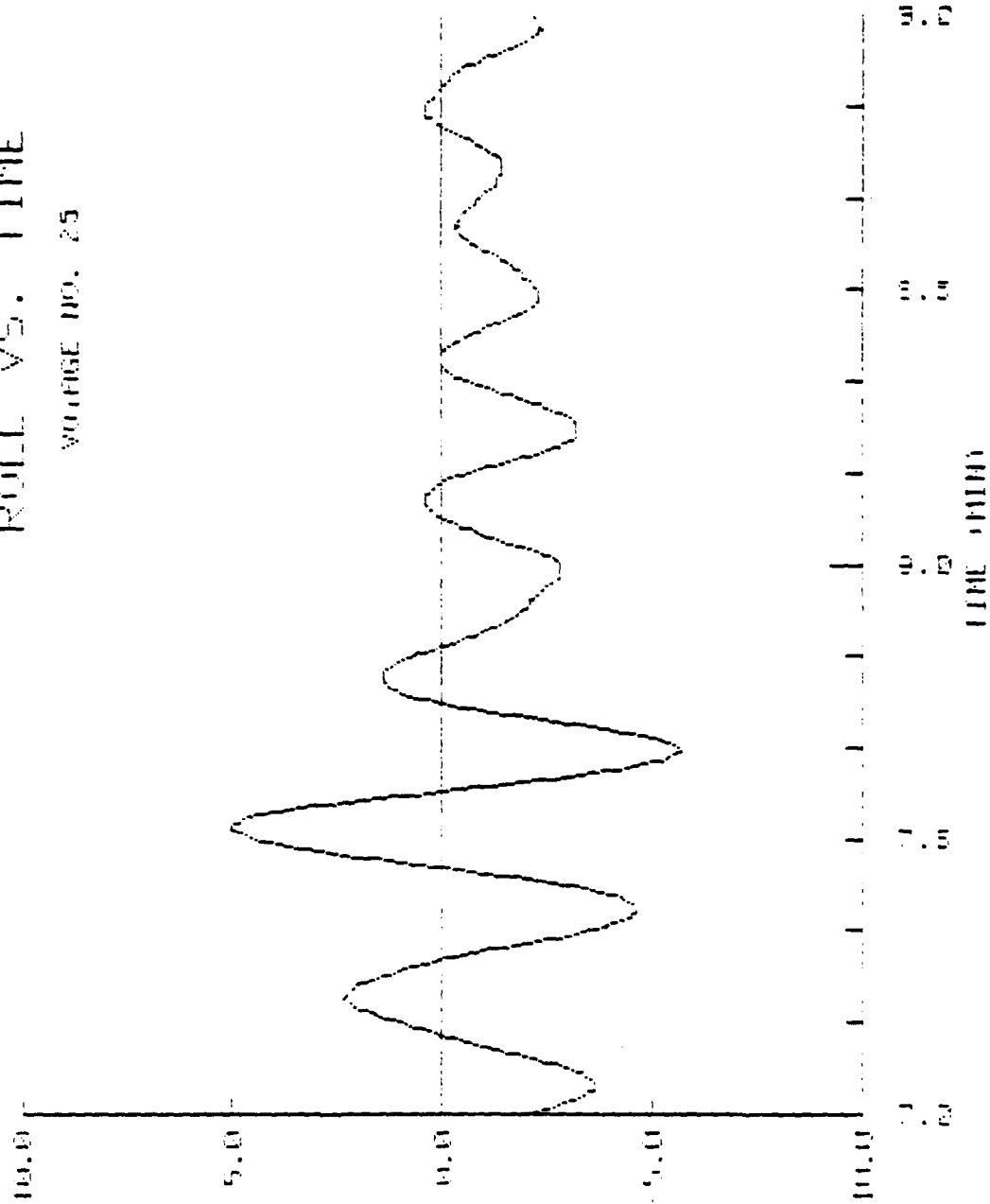
VOYAGE NO. 25





# ROLL VS. TIME

VOLUME NO. 25

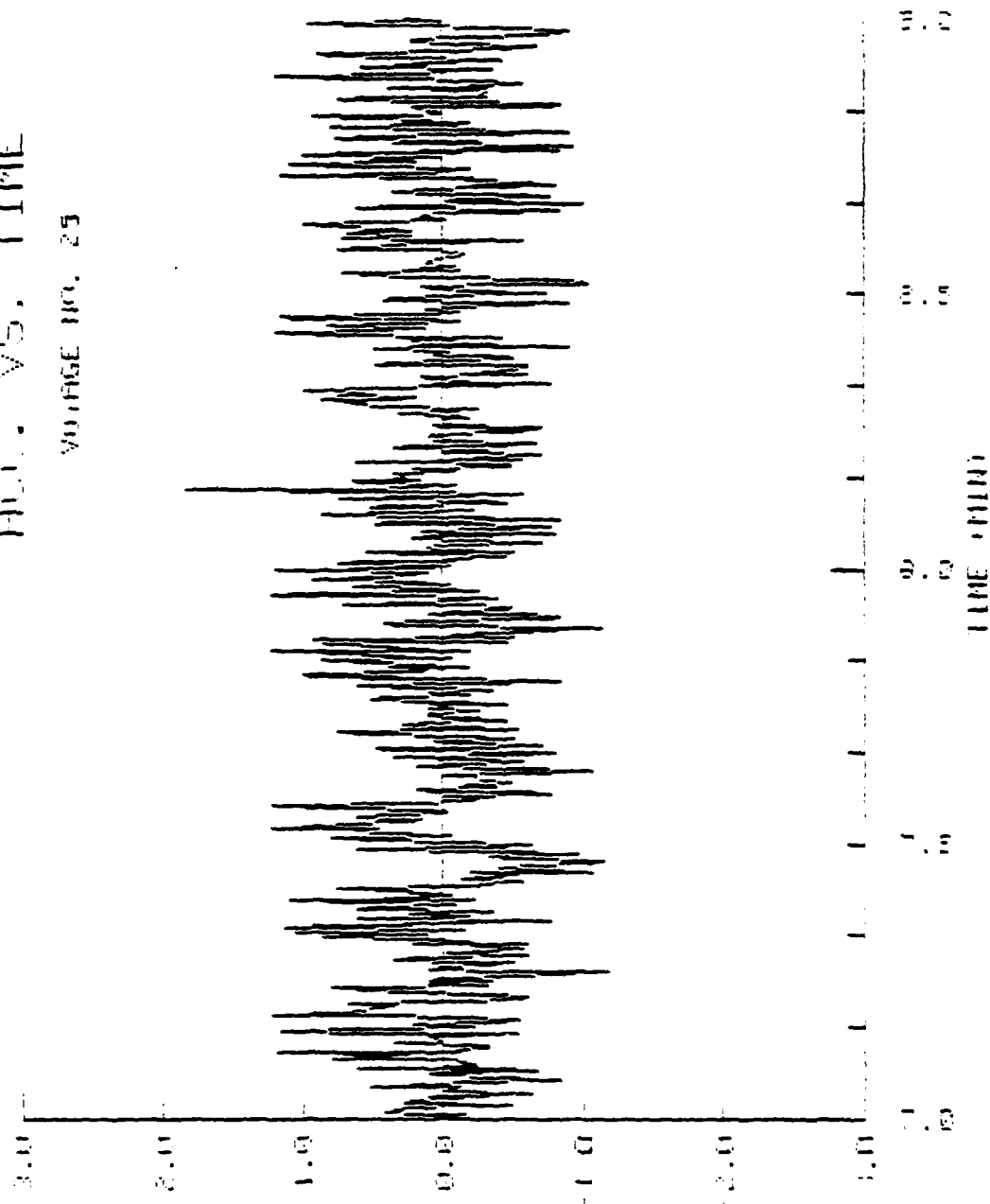


1967 7706



ALU. VS. TIME

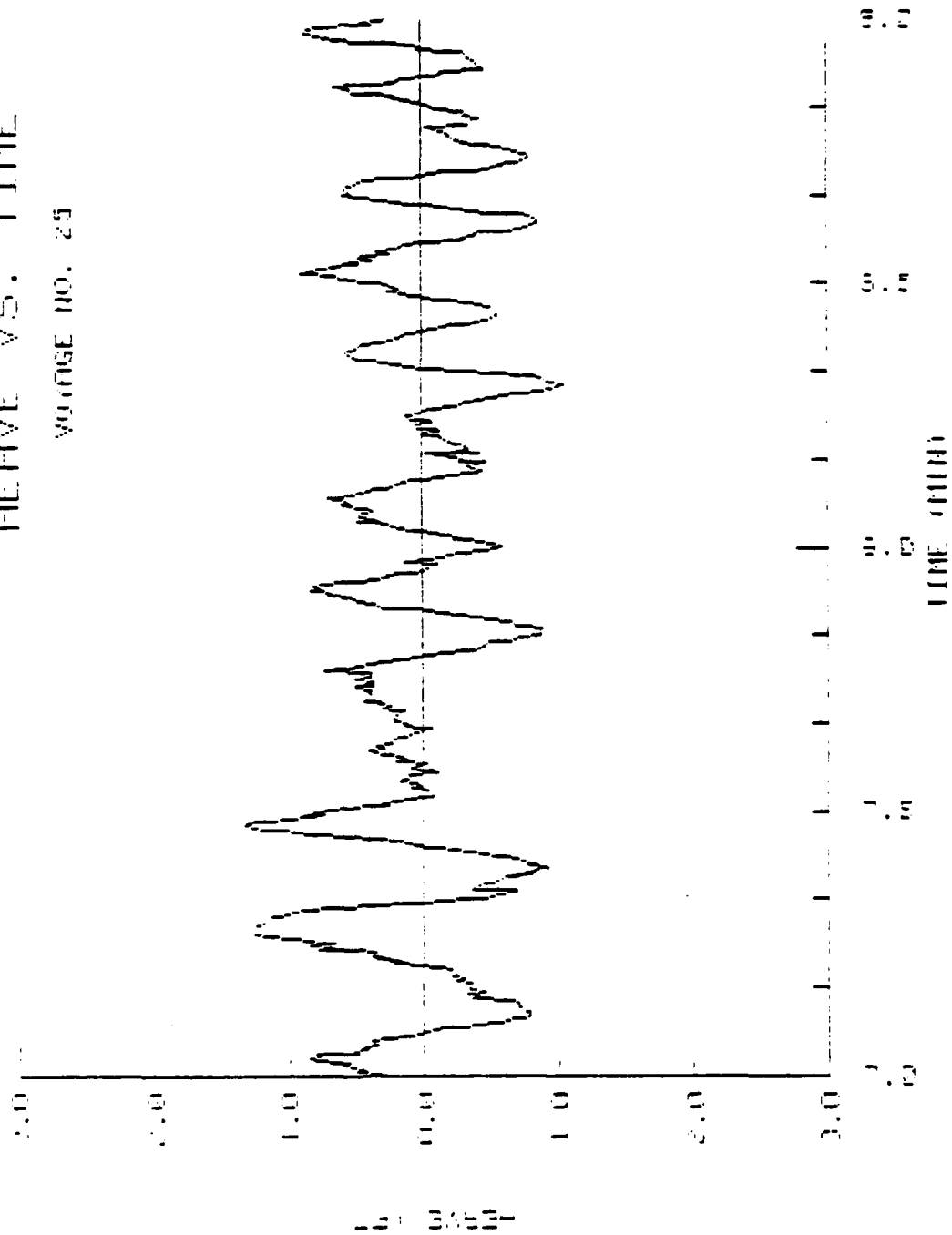
VOLUME NO. 25





# HEAVE VS. TIME

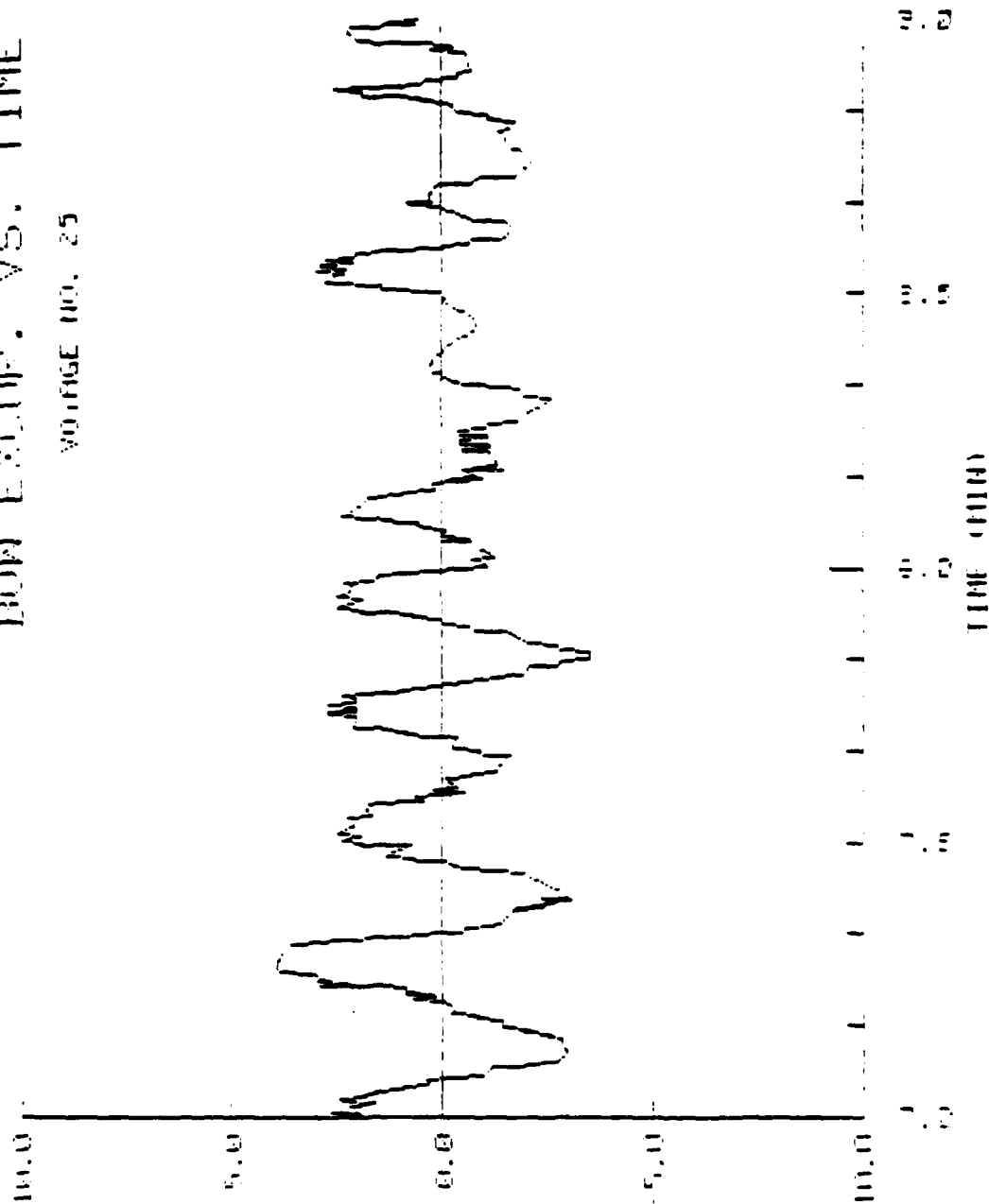
VOYAGE NO. 25





BOH EXCUR. VS. TIME

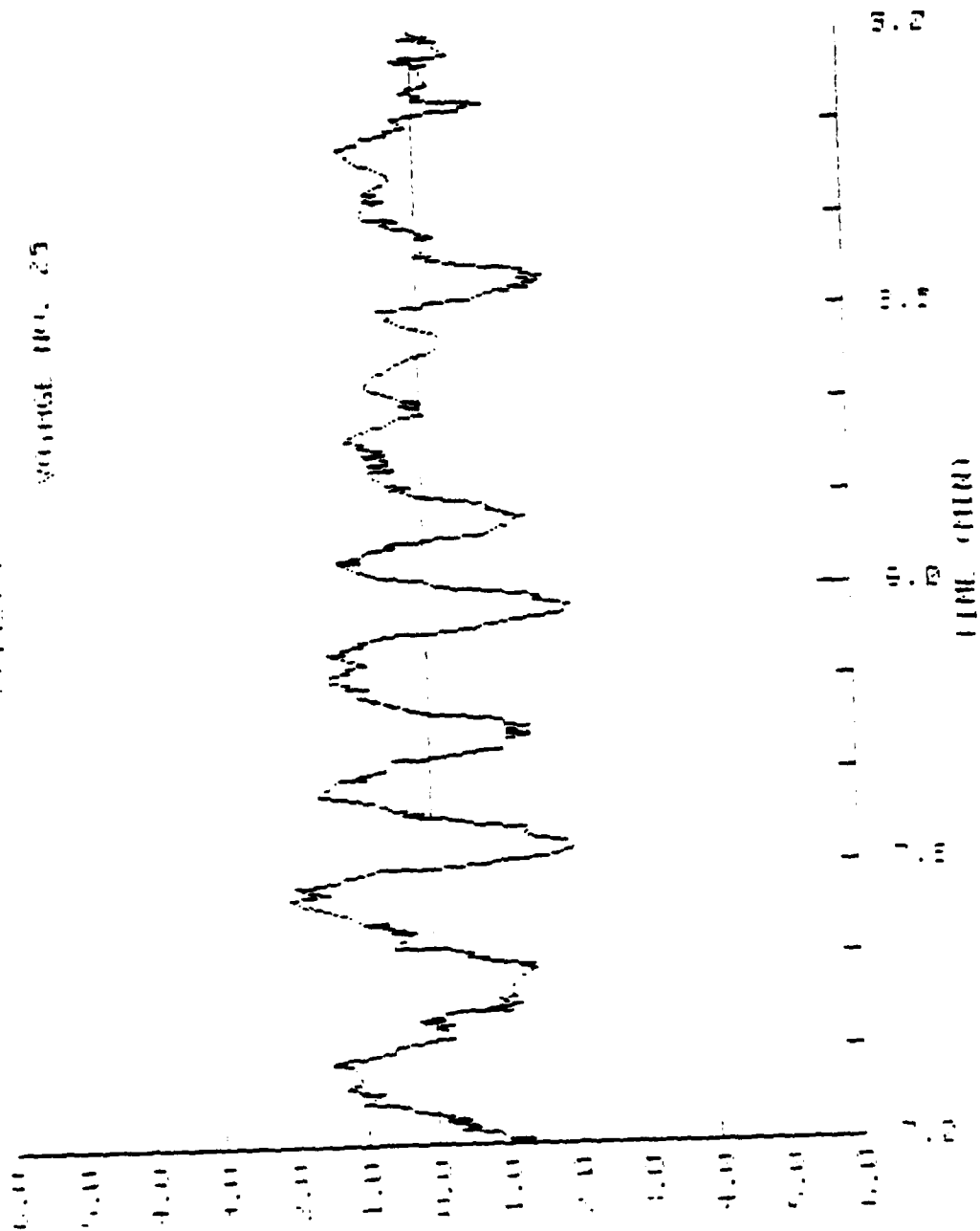
VOLUME NO. 25





5.1EPP1300P. VS. TIME

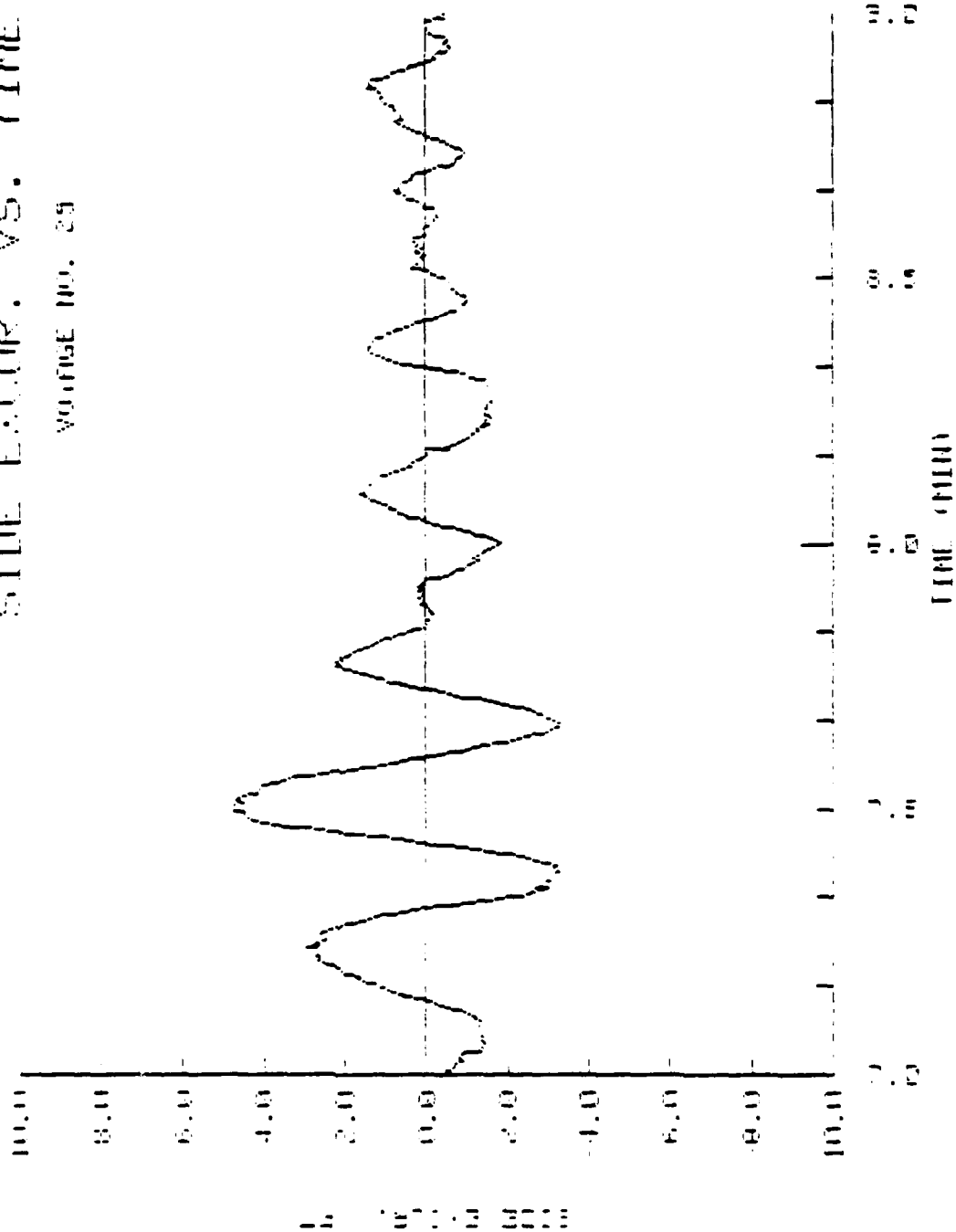
W0005E 000.25





# SIDE EXCUR. VS. TIME

VOLUME NO. 25





# STATISTICAL SUMMARY

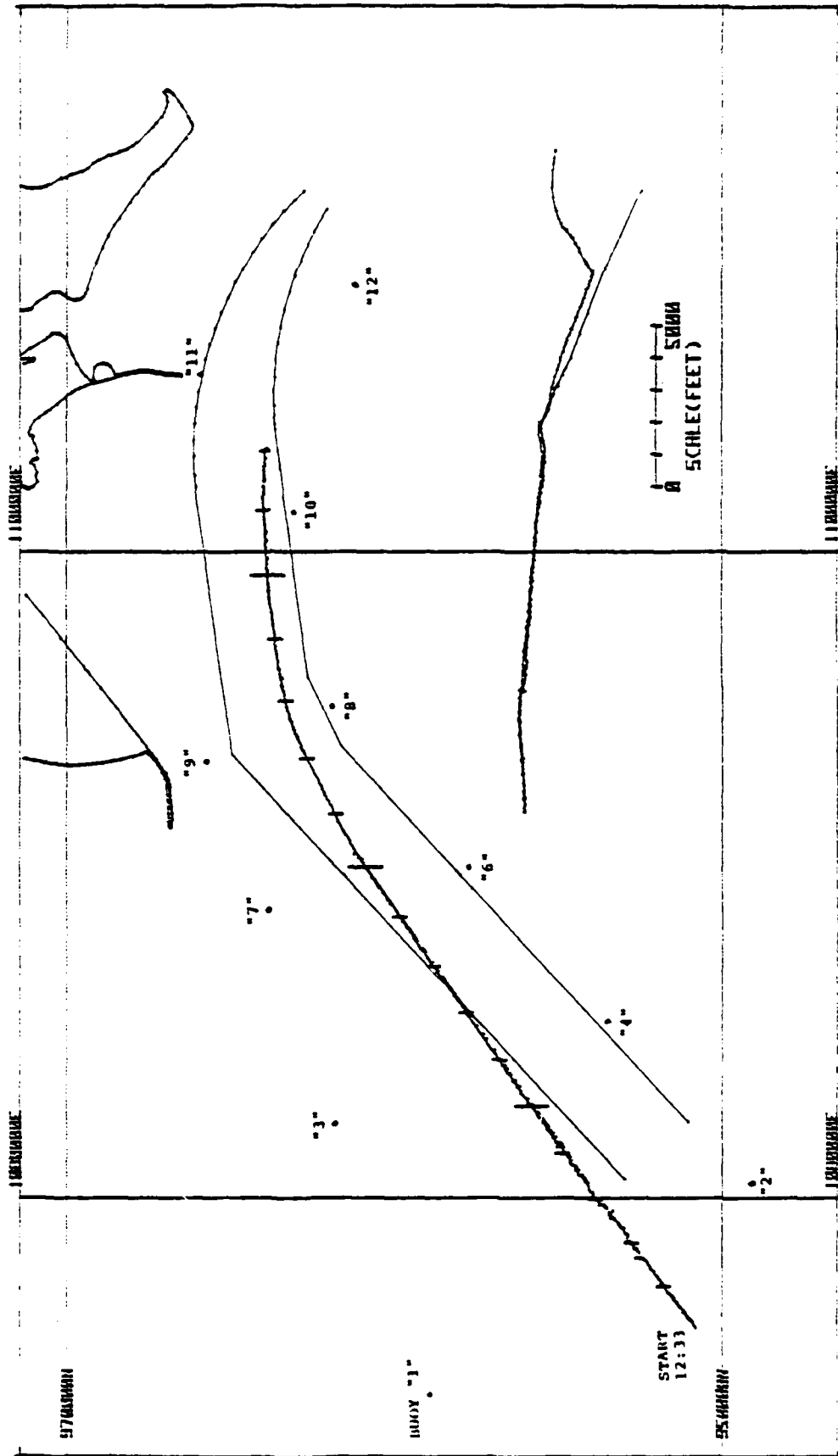
VOYAGE NO. 26

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-.1	.5	.3	.3
ROLL (DEG)	.1	2.8	1.3	1.5
HEAVE (FT)	.1	2.3	.8	.9
SWAY (FT)	.0	1.4	.6	.6
YAW (DEG)	.0	3.4	1.6	1.8
CLIP ENCLOS. (FT)	.0	1.8	.9	1.0
CLIP ENCLOS. (FT)	.0	2.5	1.3	1.5



# VOYAGE NO. 26 SHIP TRACK

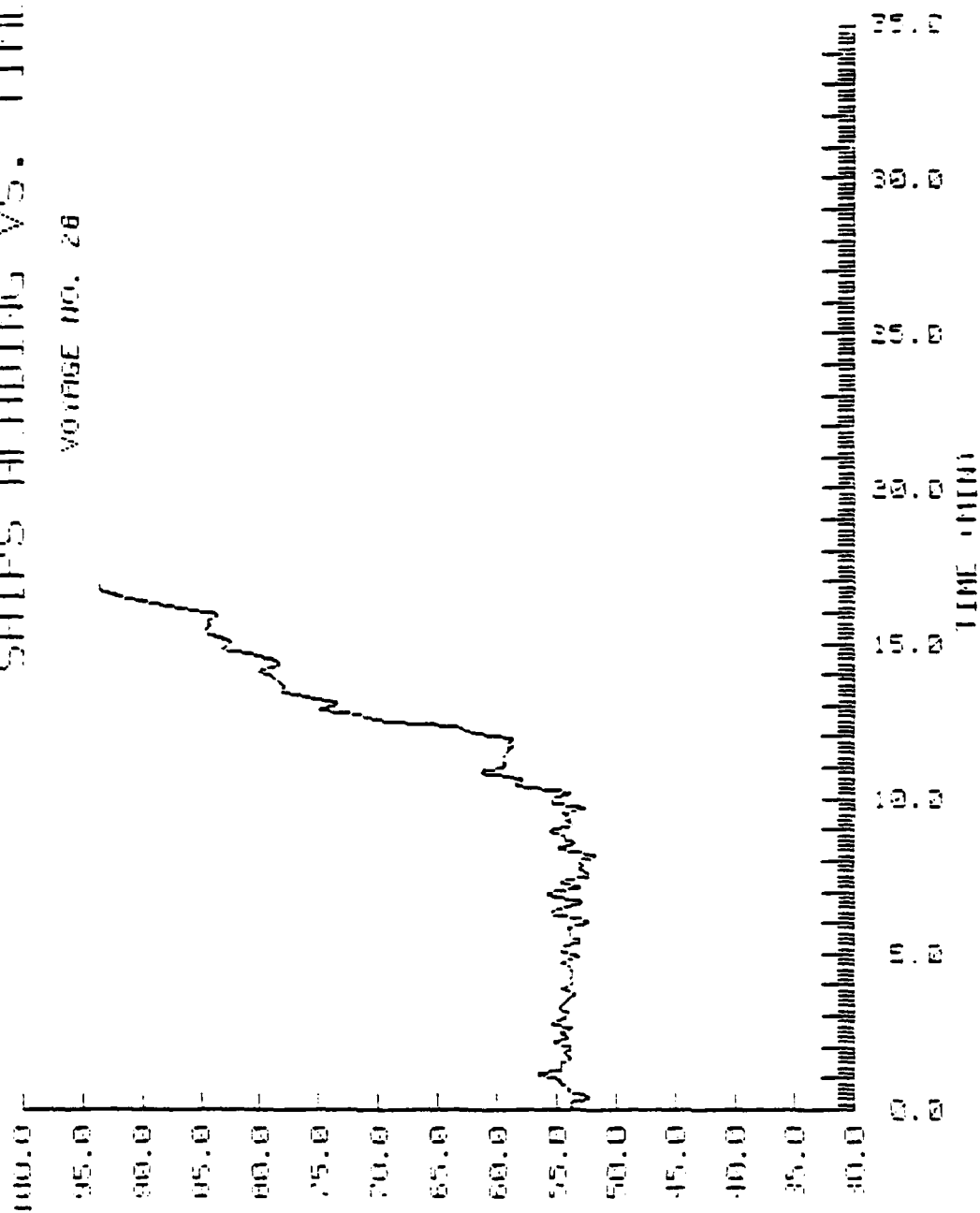
SCENE 1: 30000





# SHIPS HEADING VS. TIME

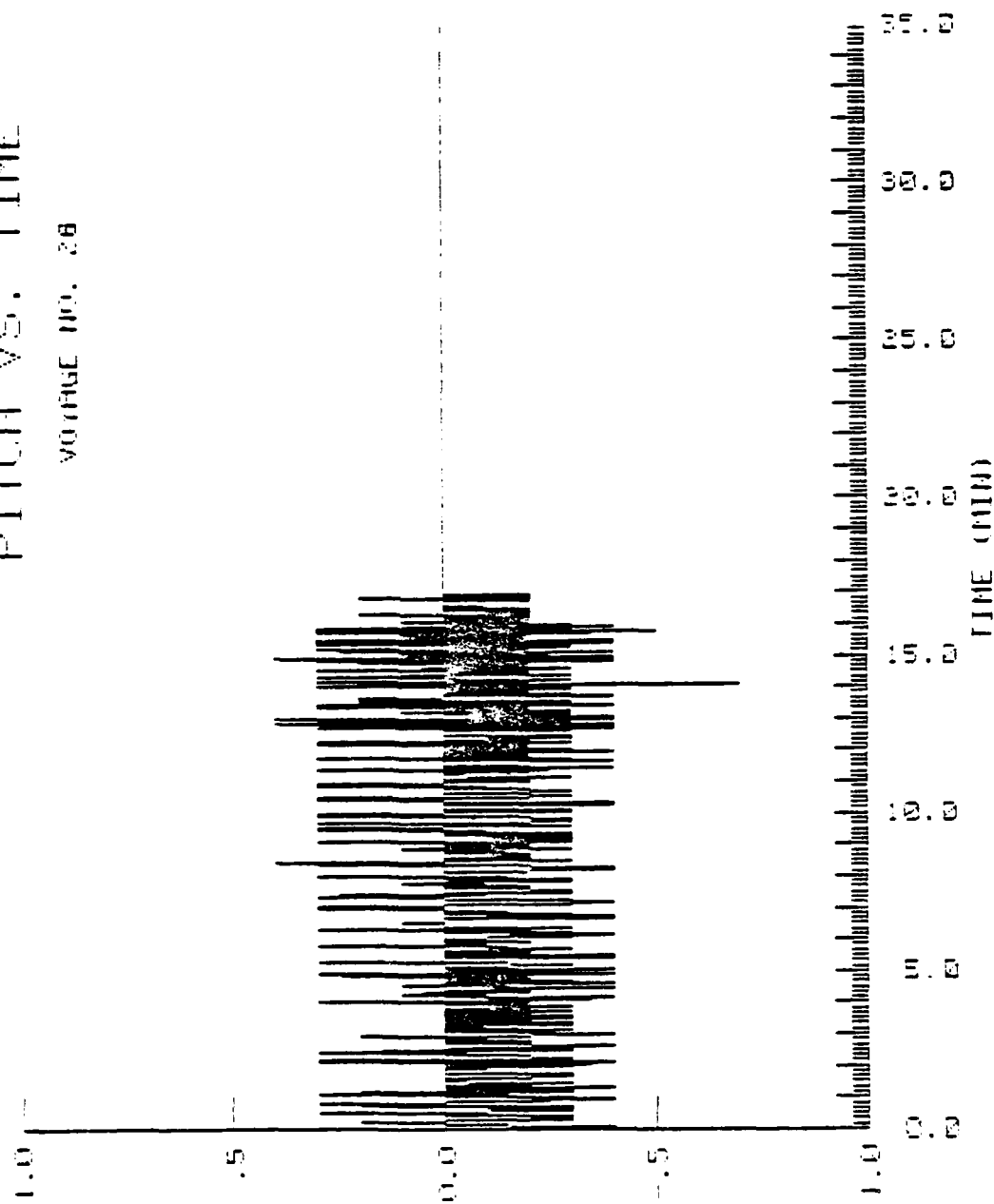
VOYAGE NO. 28





# PITCH VS. TIME

VOLUME NO. 28

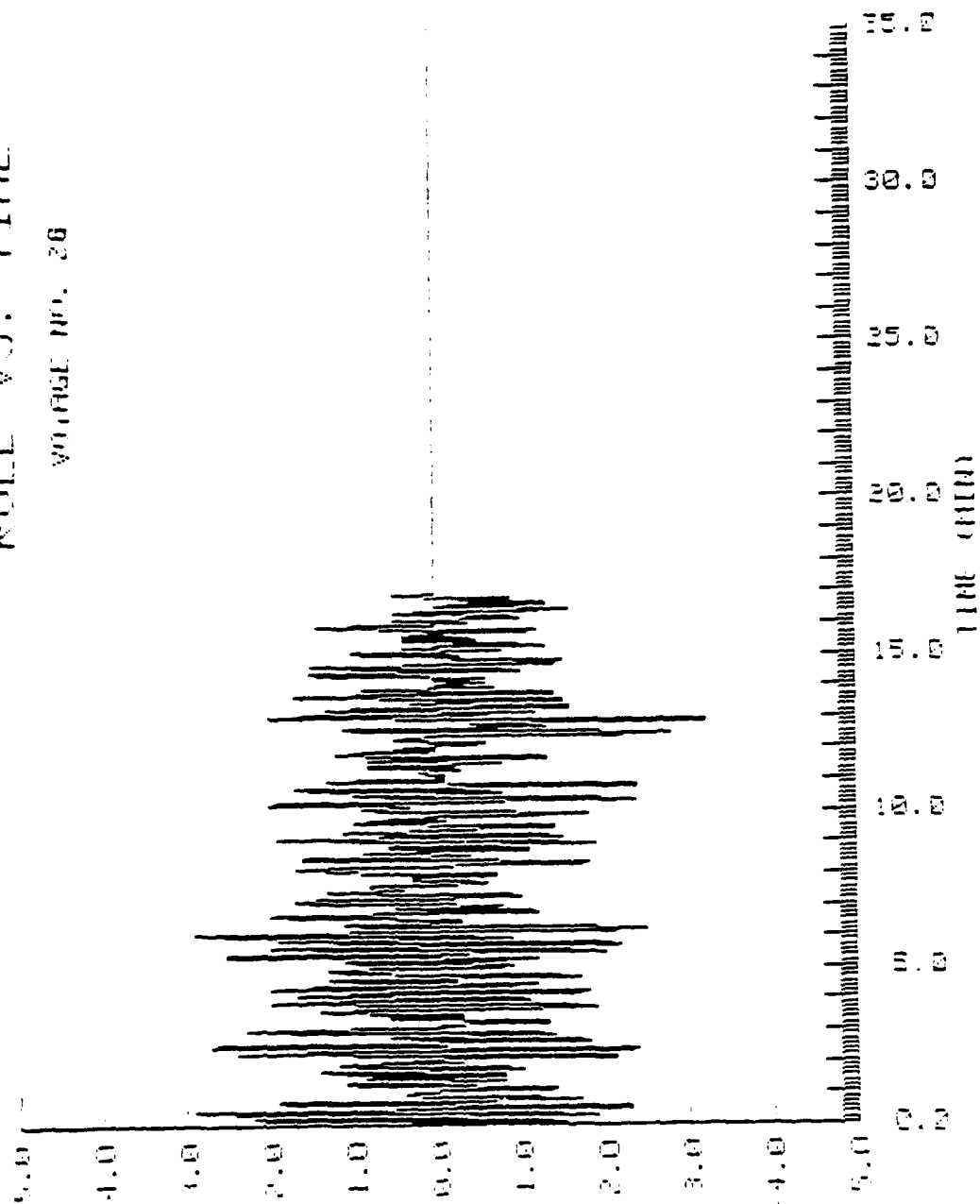


1961-12-11



# ROLL VS. TIME

VORAGE NO. 26

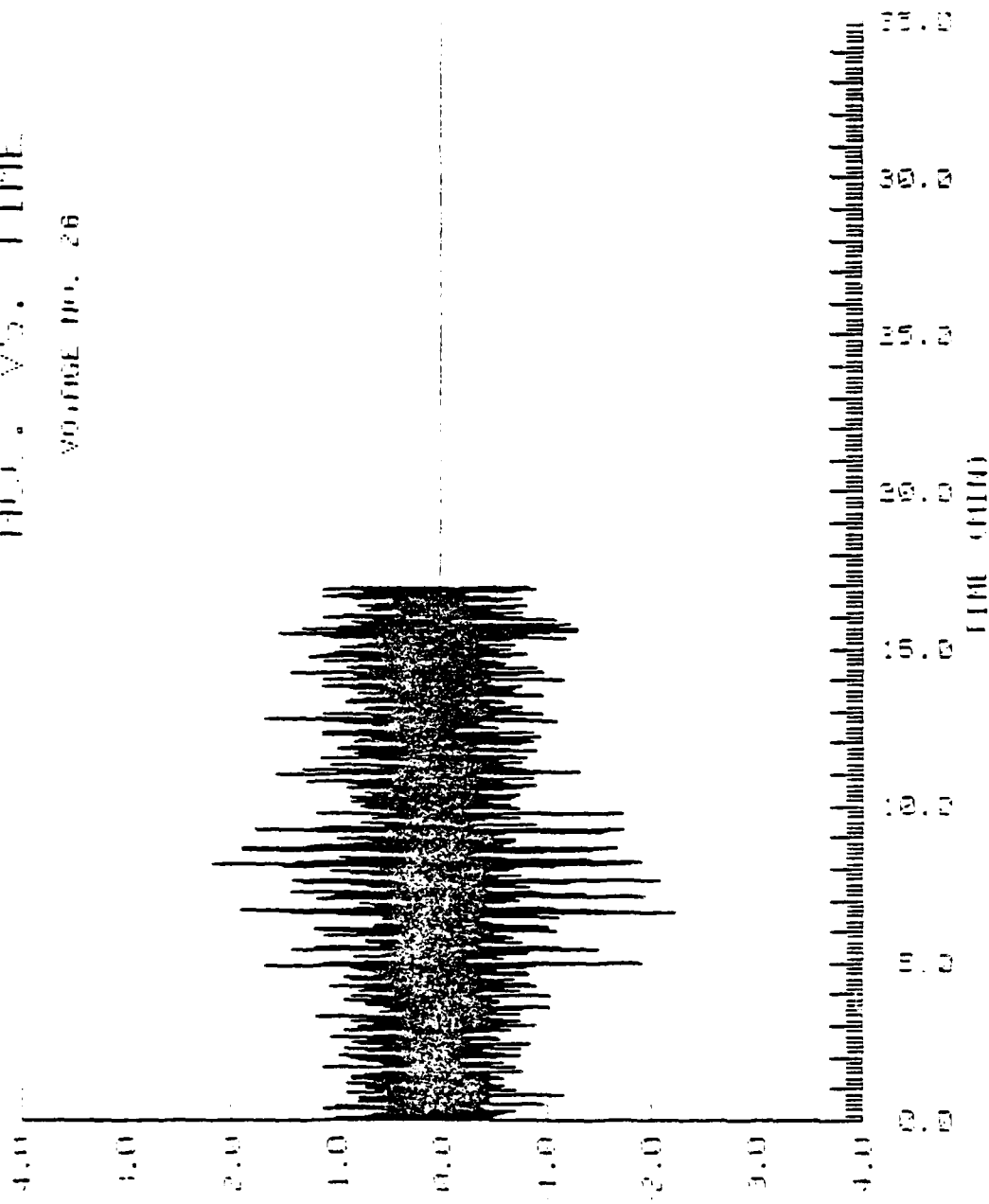


0001 1116



# NOISE VS. TIME

VOLUME 100, 26



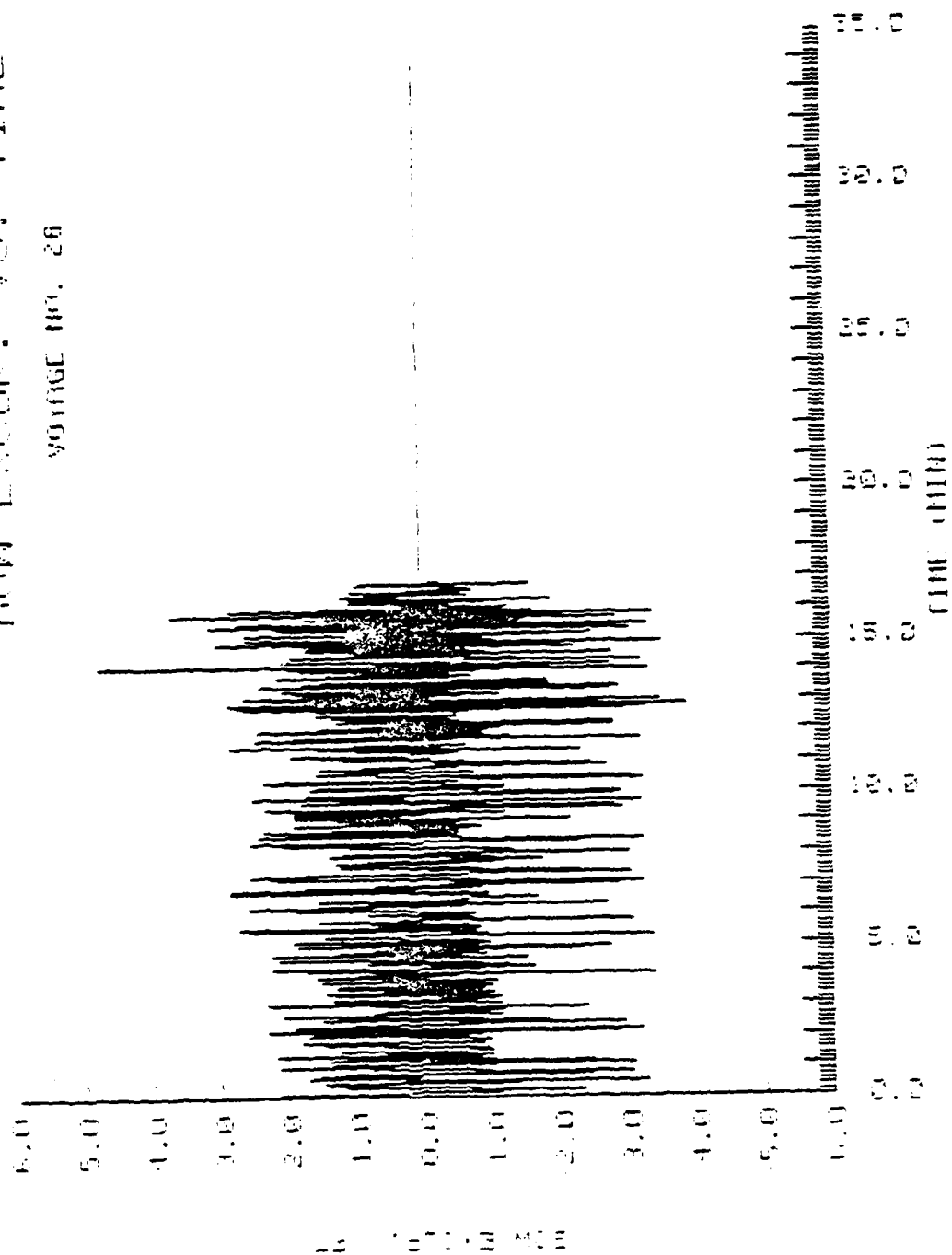
100 100 100 100







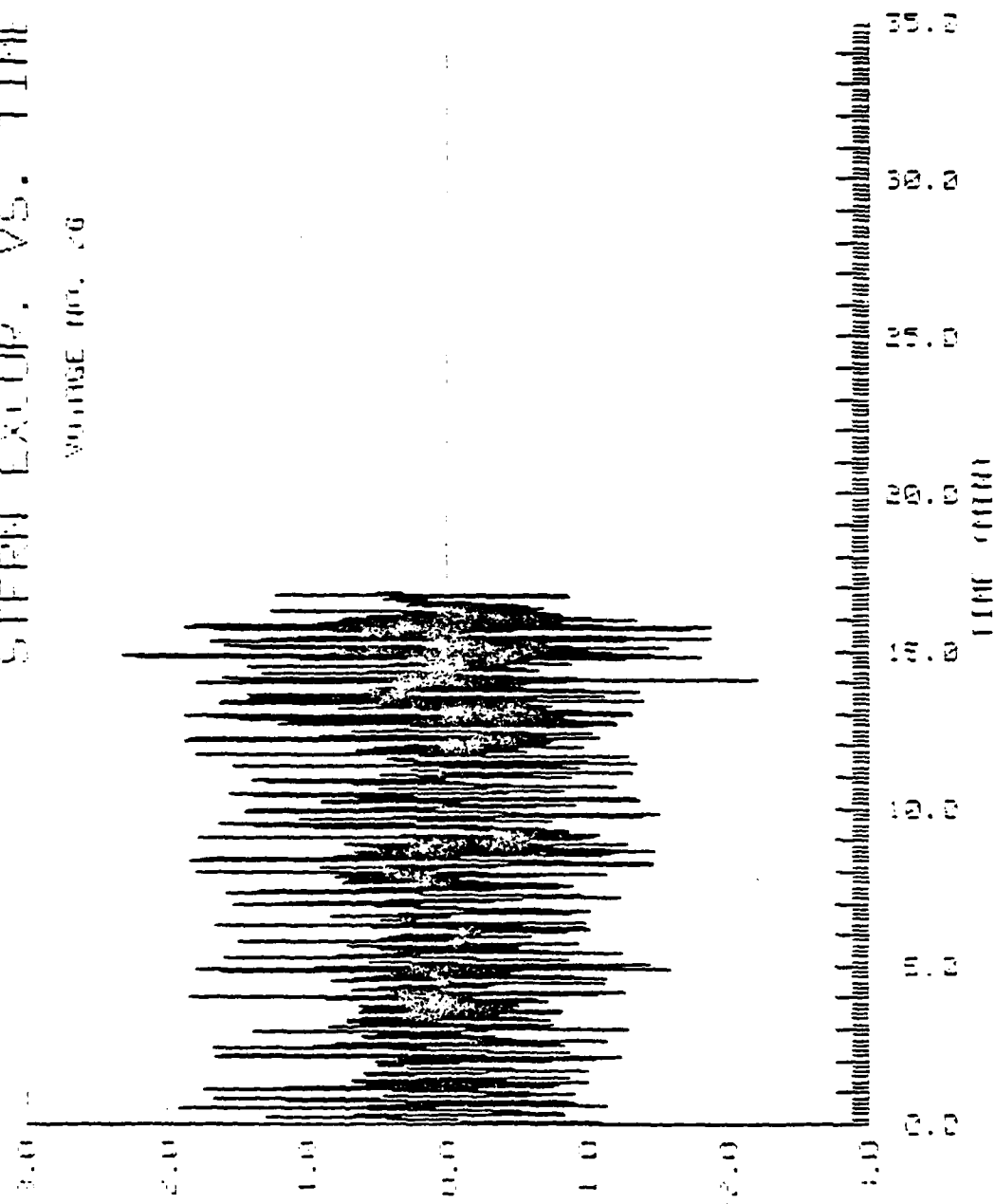
# HOW EXCUR. VS. TIME YOUNG NO. 26





SLEEP EXCUP. VS. TIME  
WONCE 100. 20

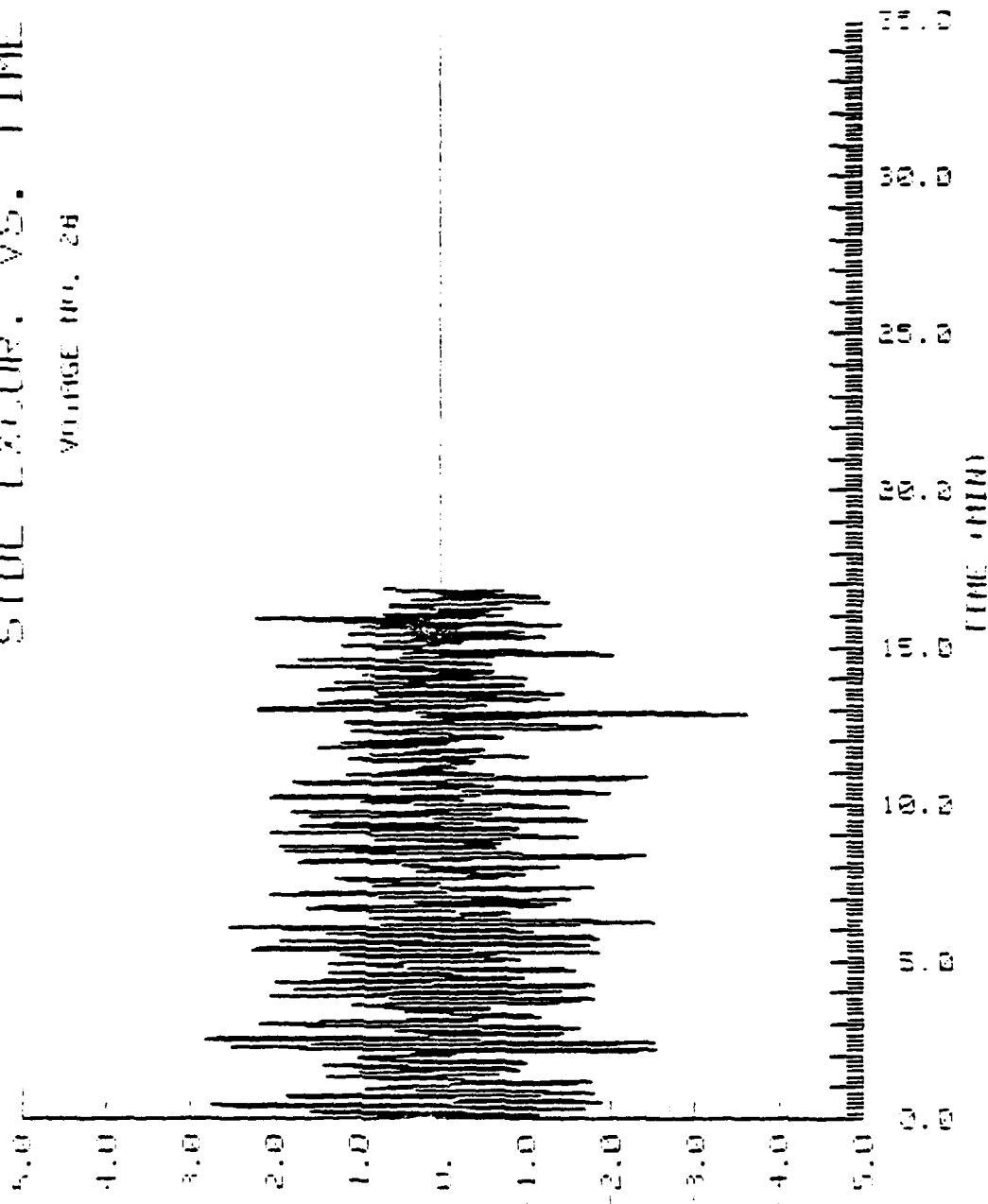
WILLIAM W. 20





# SIDE LACUR. VS. TIME

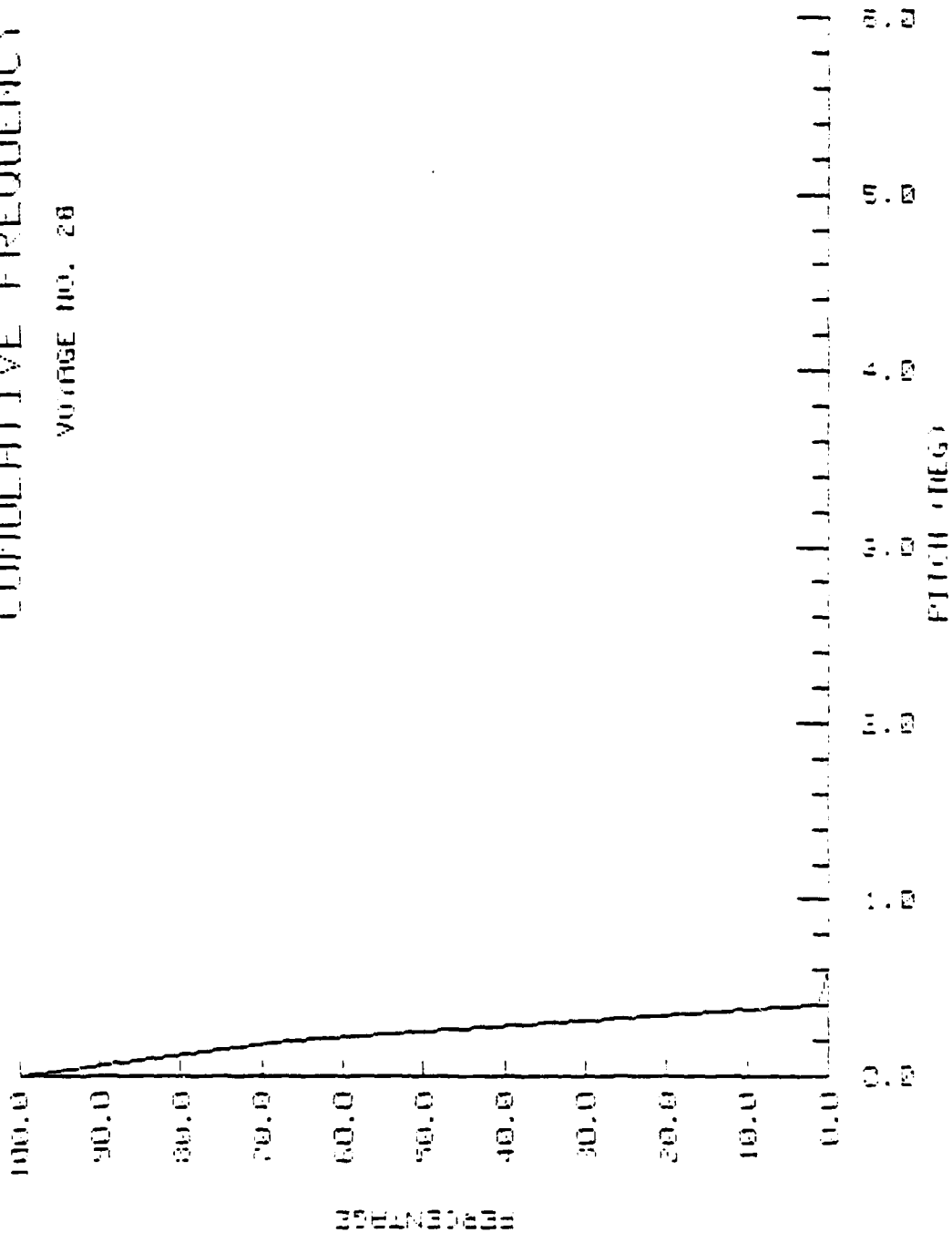
VOLUME 100, 20





# CUMULATIVE FREQUENCY

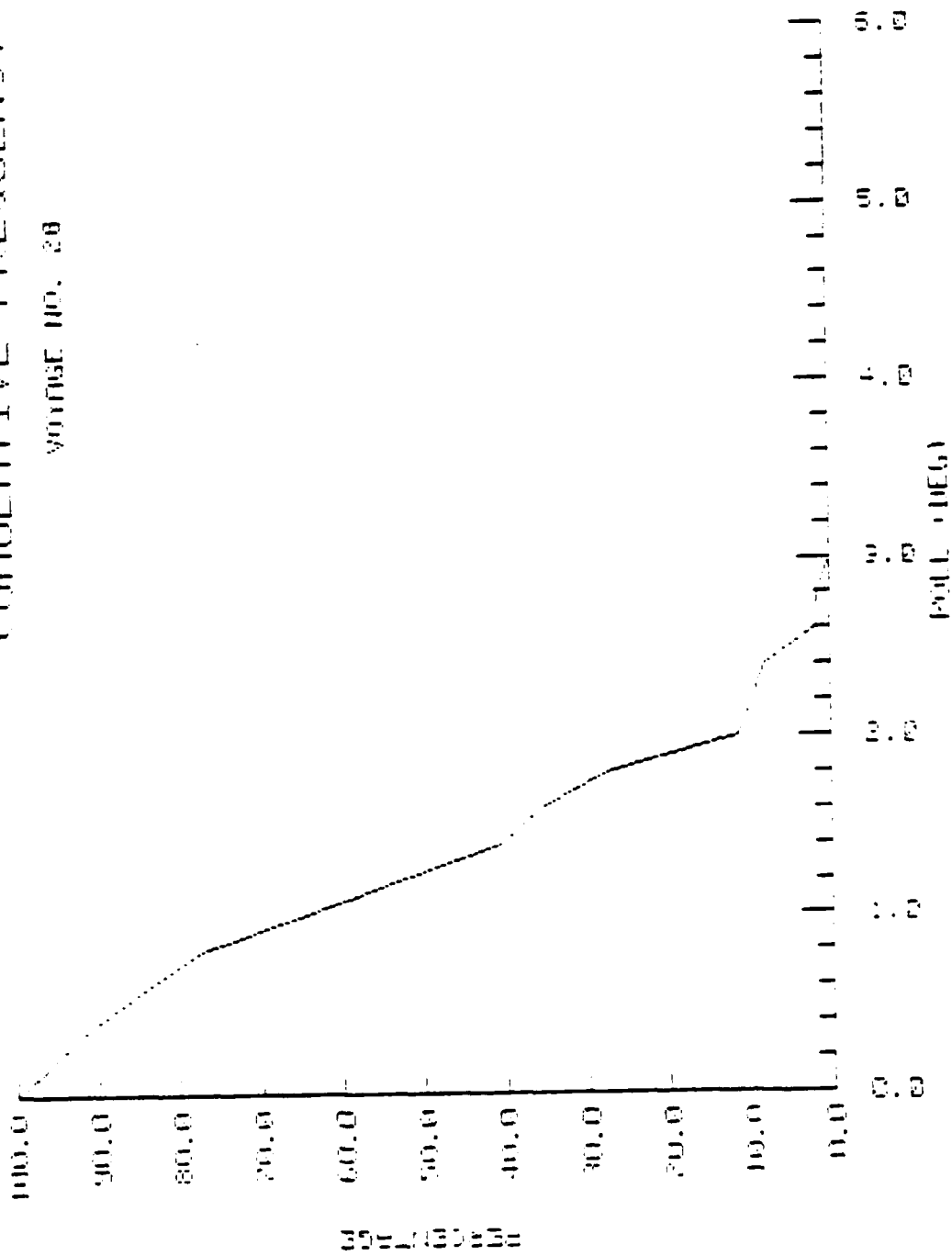
VOLUME NO. 28





# CUMULATIVE FREQUENCY

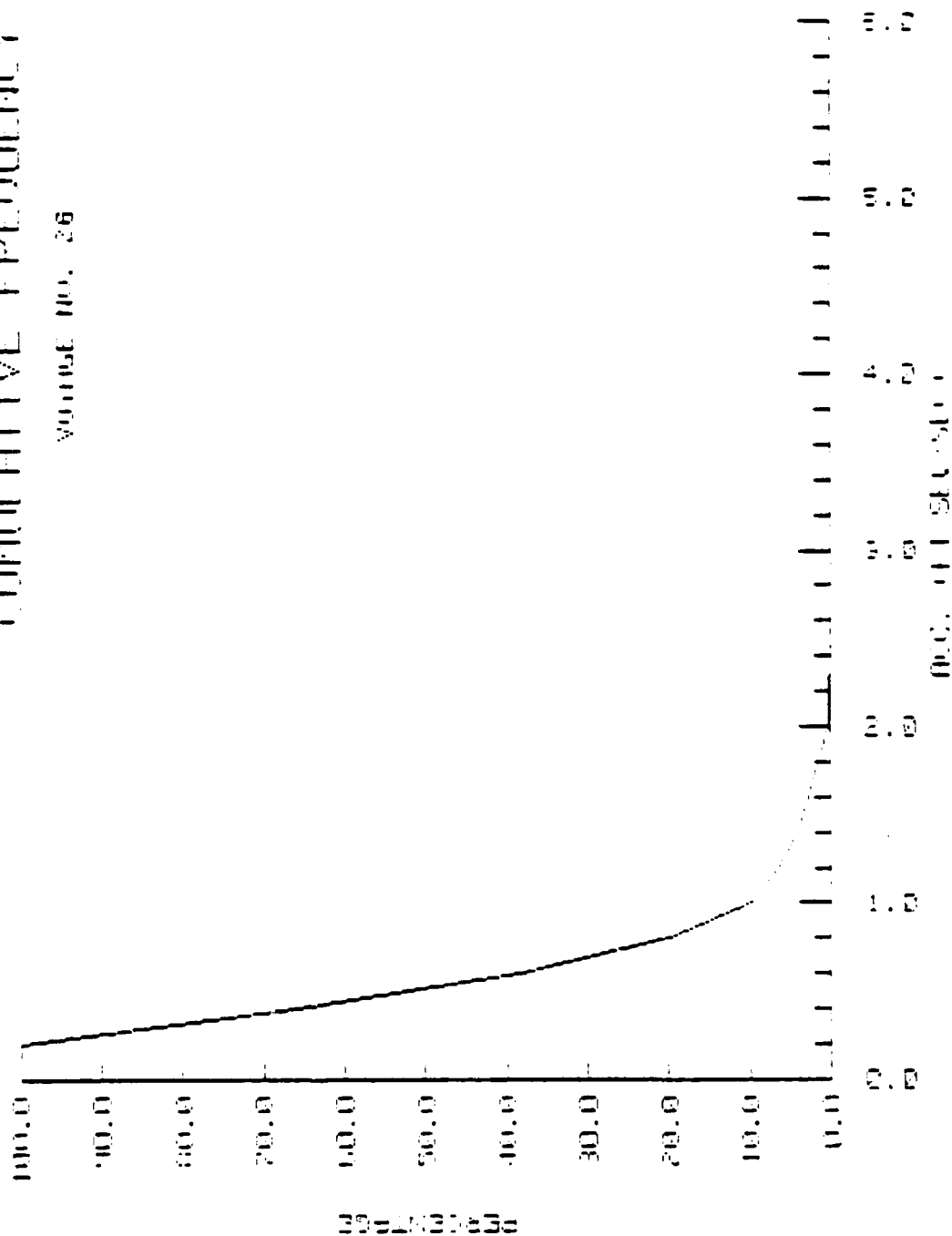
YOUNG NO. 20





# CUMULATIVE FREQUENCY

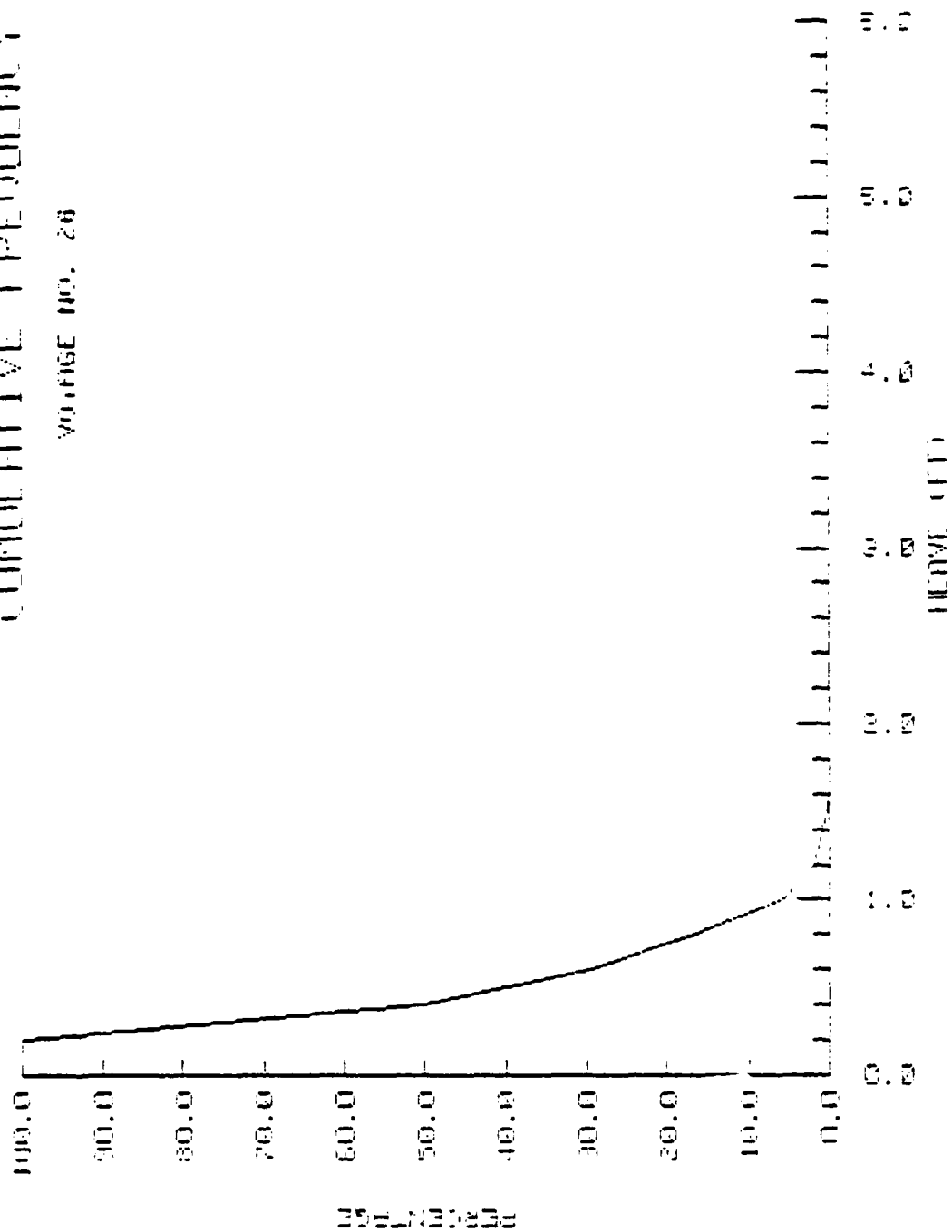
YOUNG NO. 26





# CUMULATIVE FREQUENCY

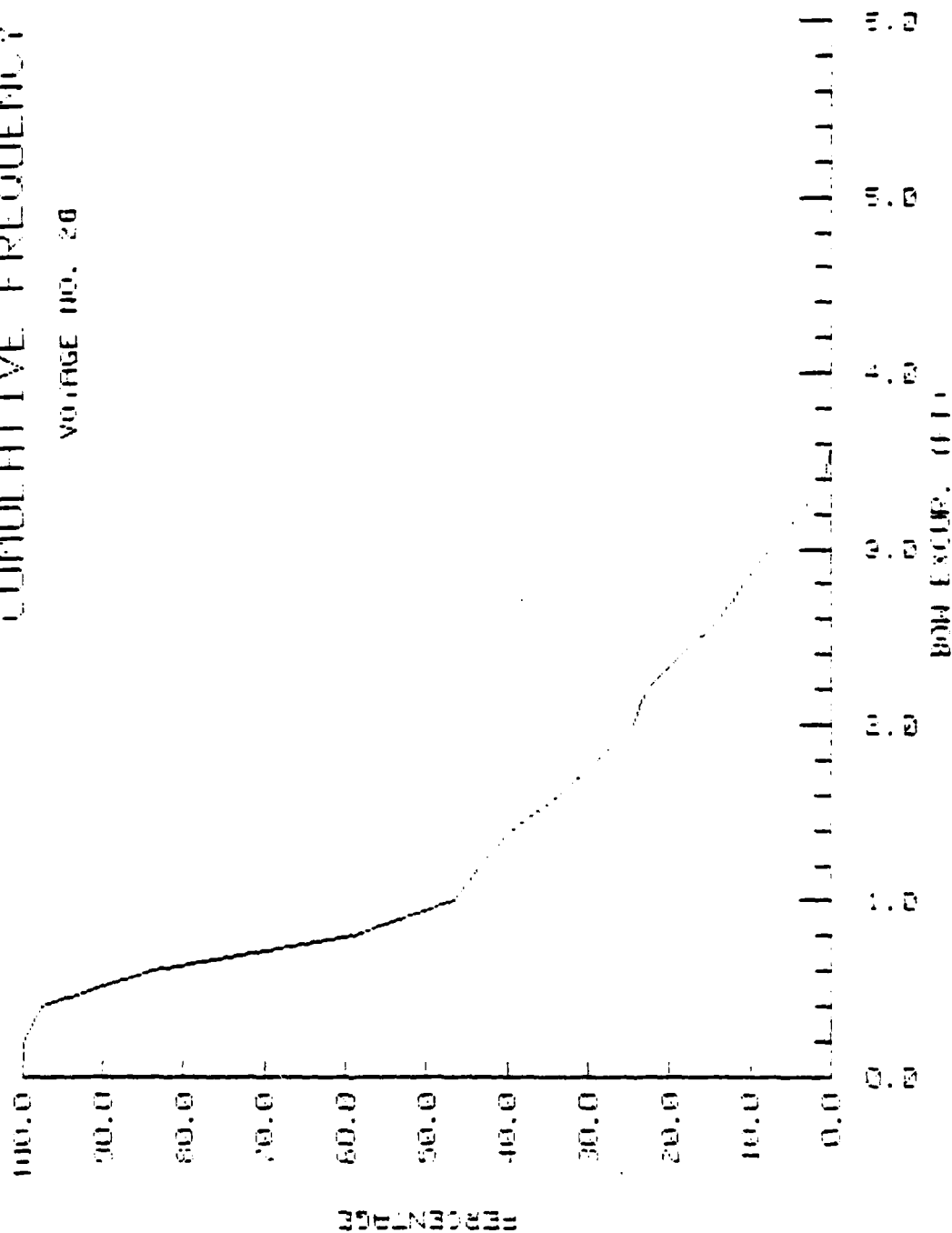
VOYAGE NO. 26





# CUMULATIVE FREQUENCY

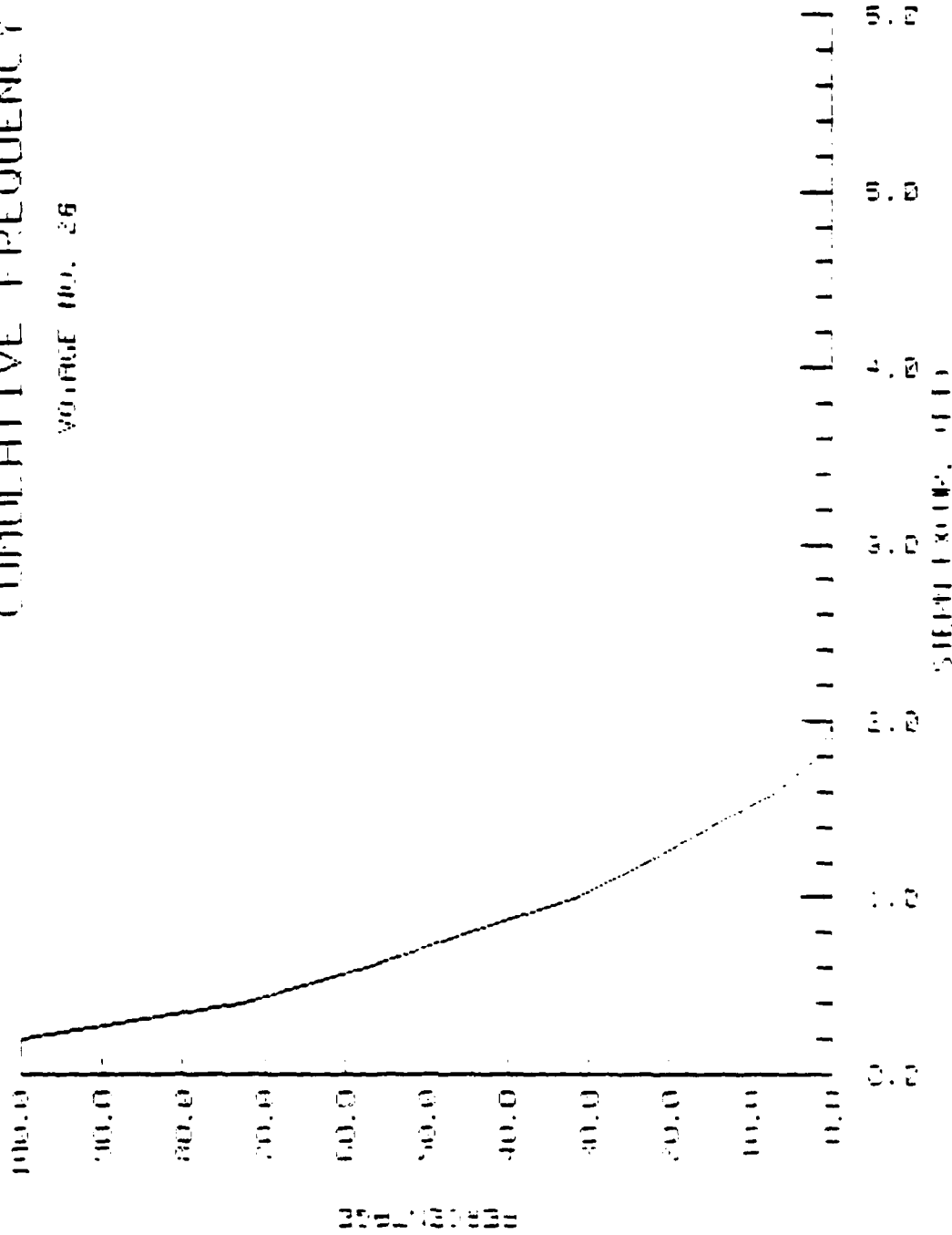
VOLAGE NO. 20





# CUMULATIVE FREQUENCY

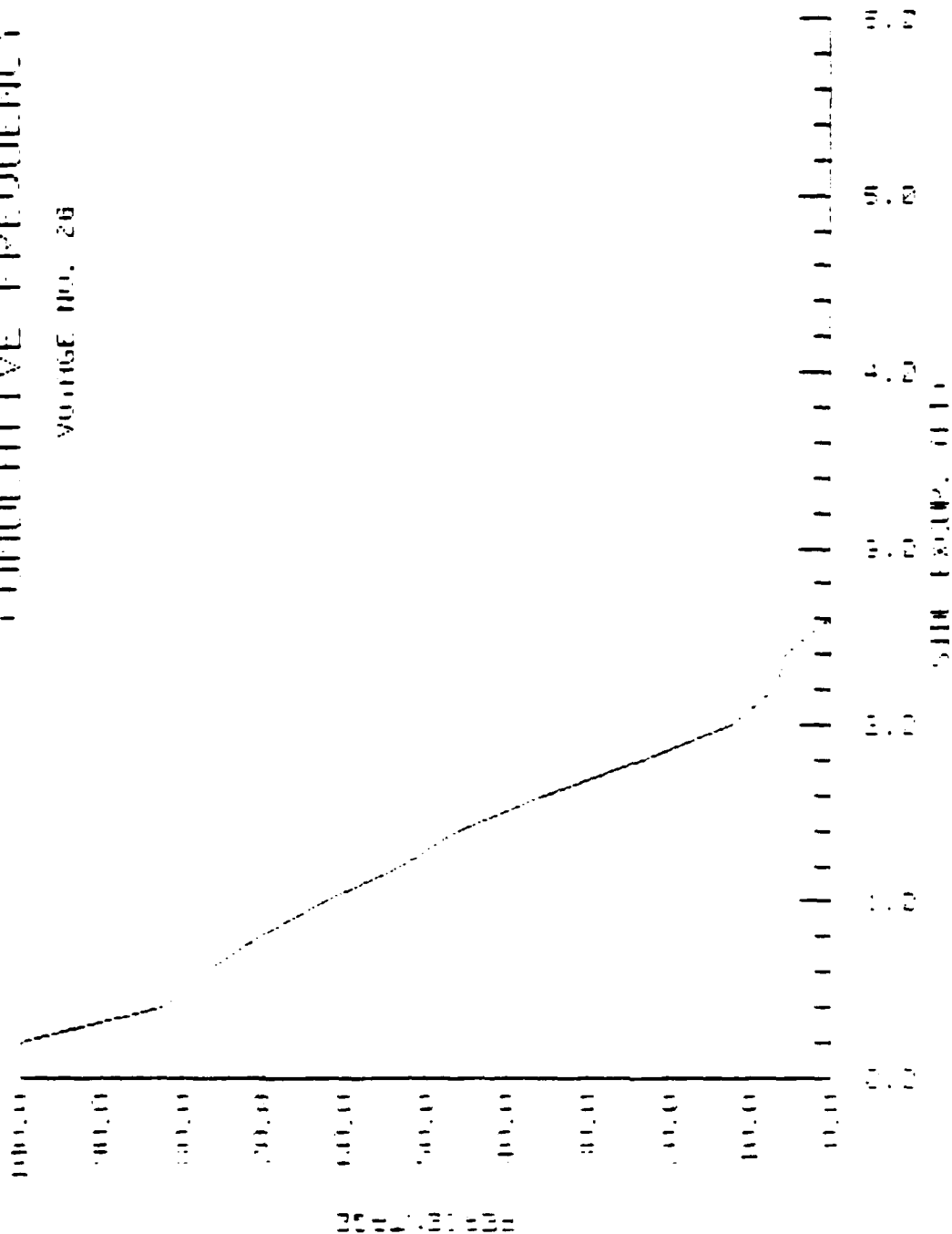
VOLUME NO. 26





# CUMULATIVE FREQUENCY

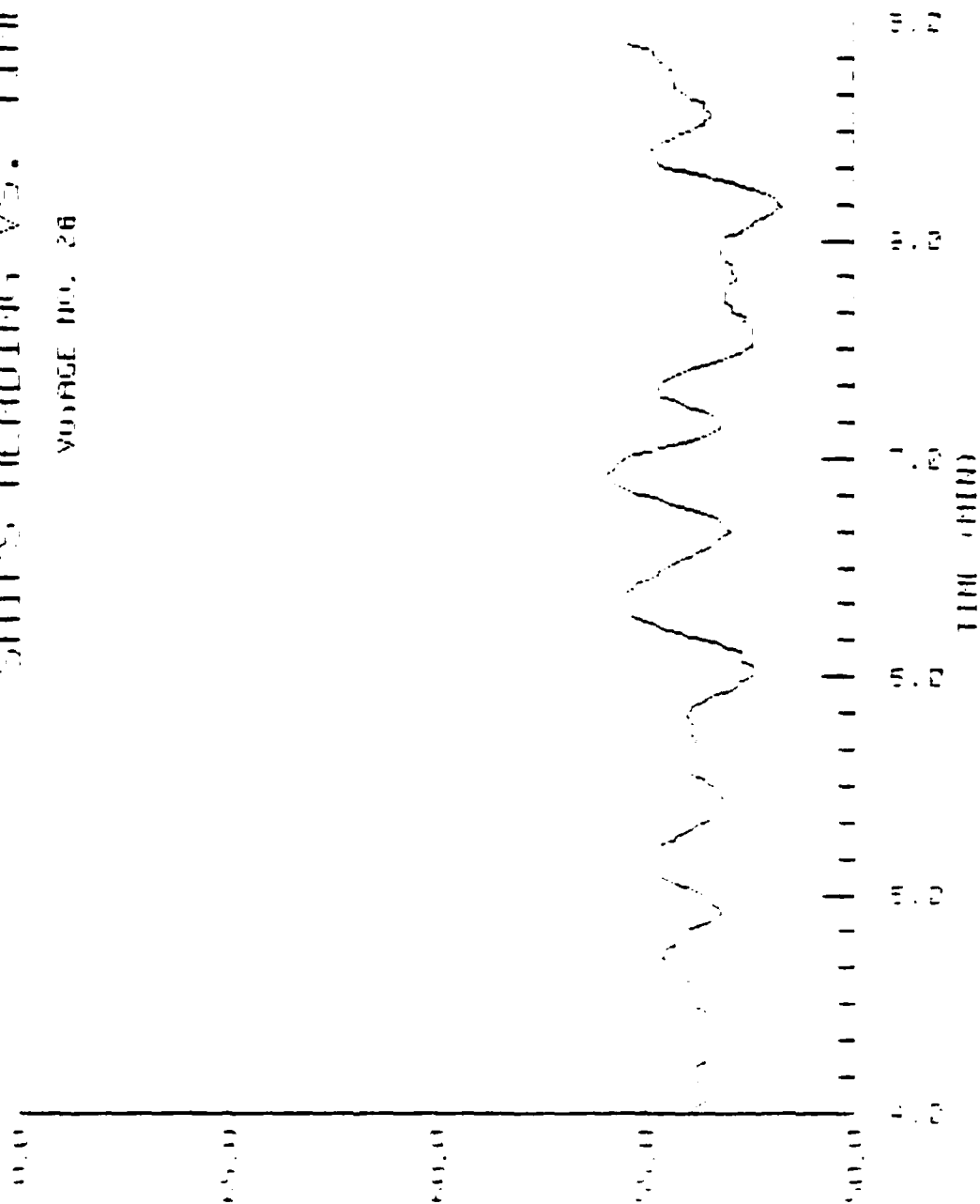
YOUNG NO. 26





# SHIPS HOLDING VS. TIME

VOLUME NO. 26

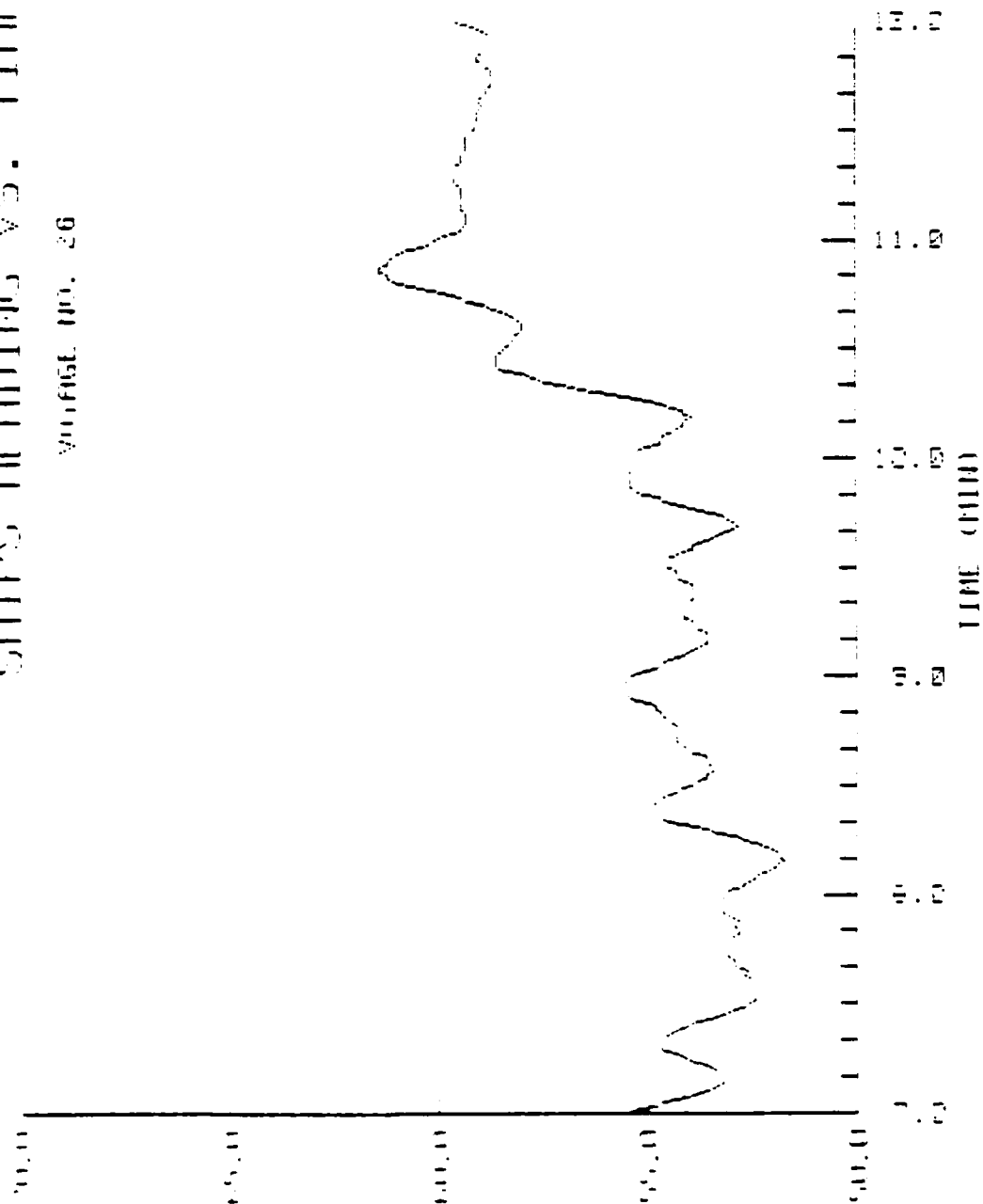


130 0.000-37 0.000-13



# SAMPLES INCLUDING VS. TIME

VOLUME NO. 26

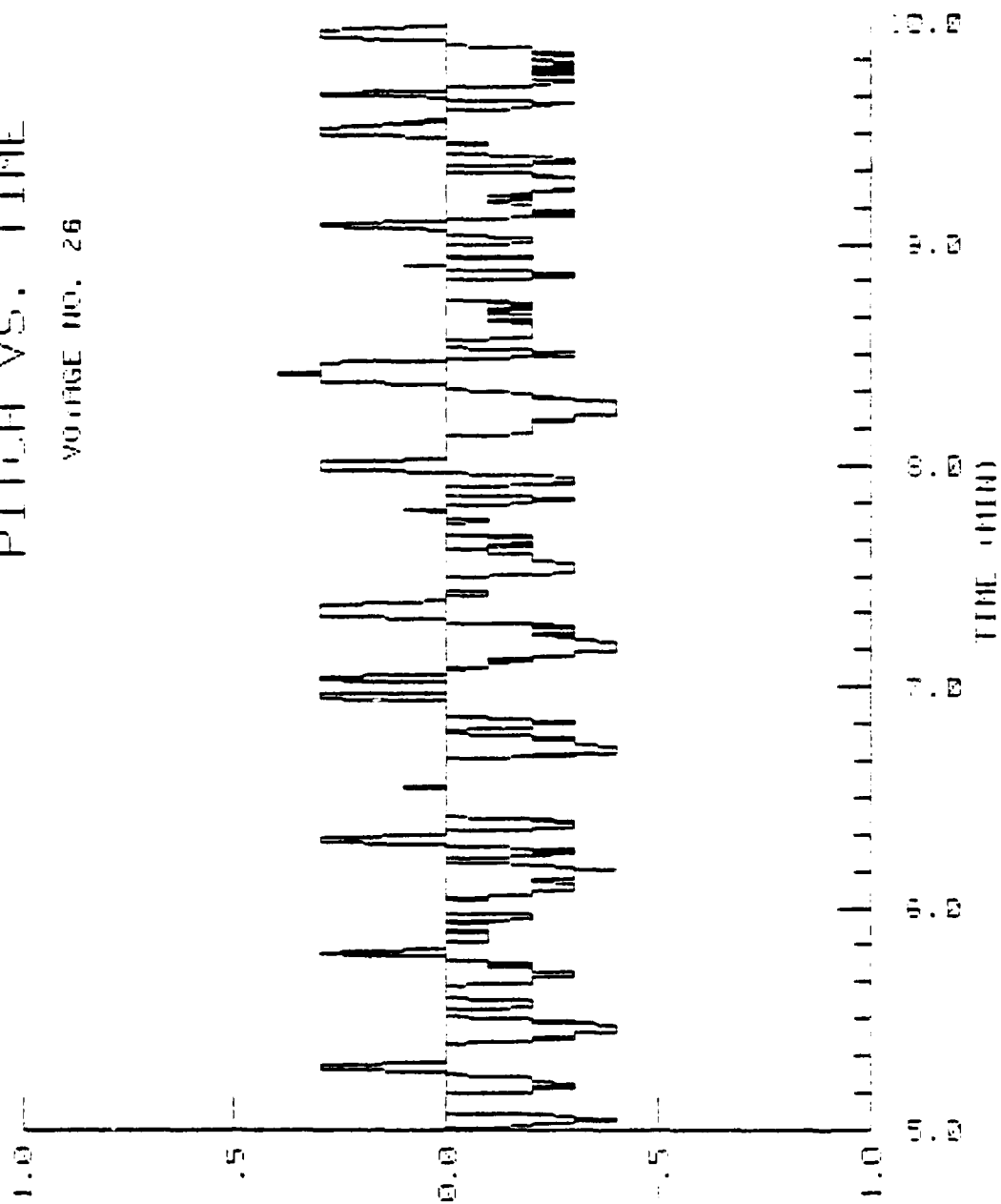


100 0.00000-00000



# PITCH VS. TIME

VOICE NO. 26



PITCH - DEG.



# POLL. VS. TIME

VOLUME 100, 20

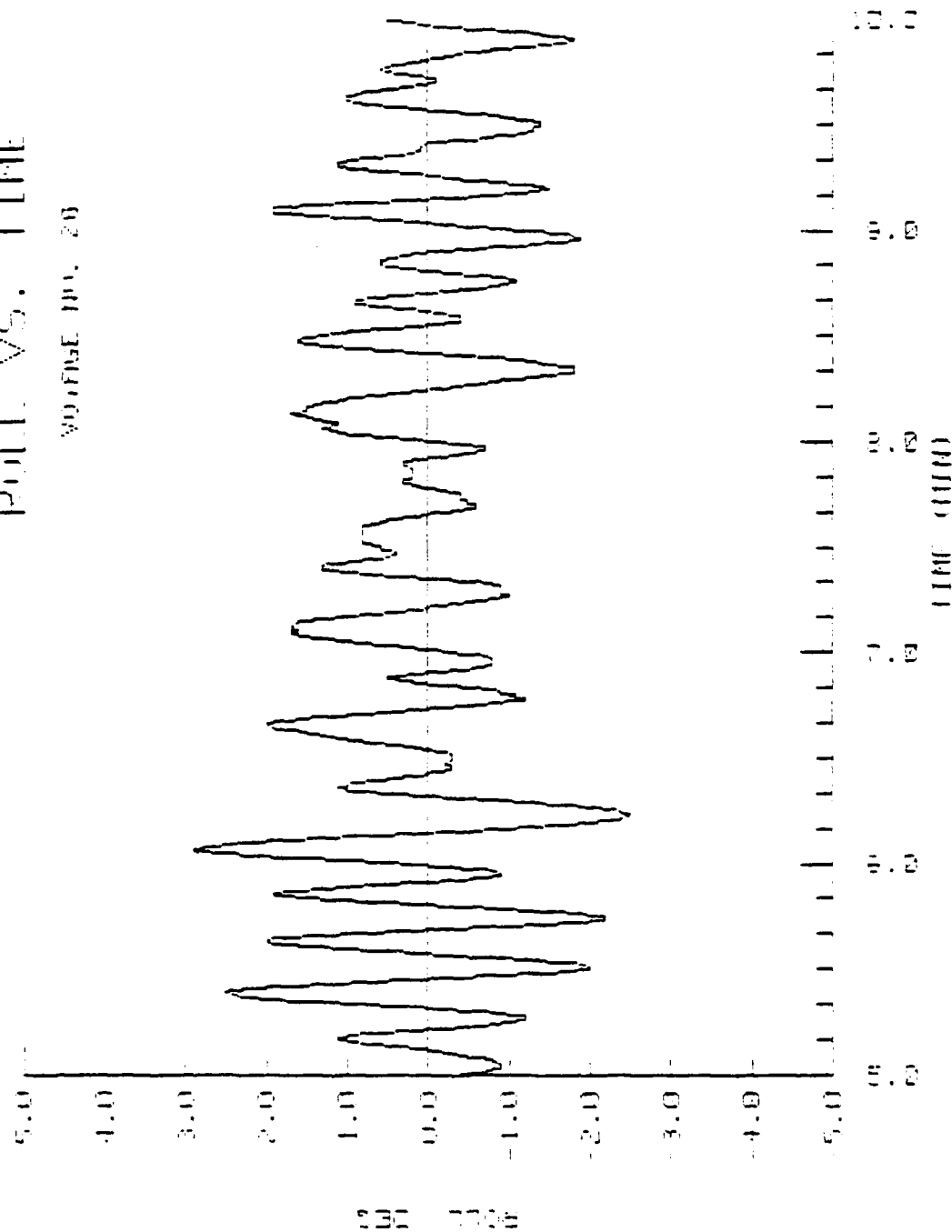
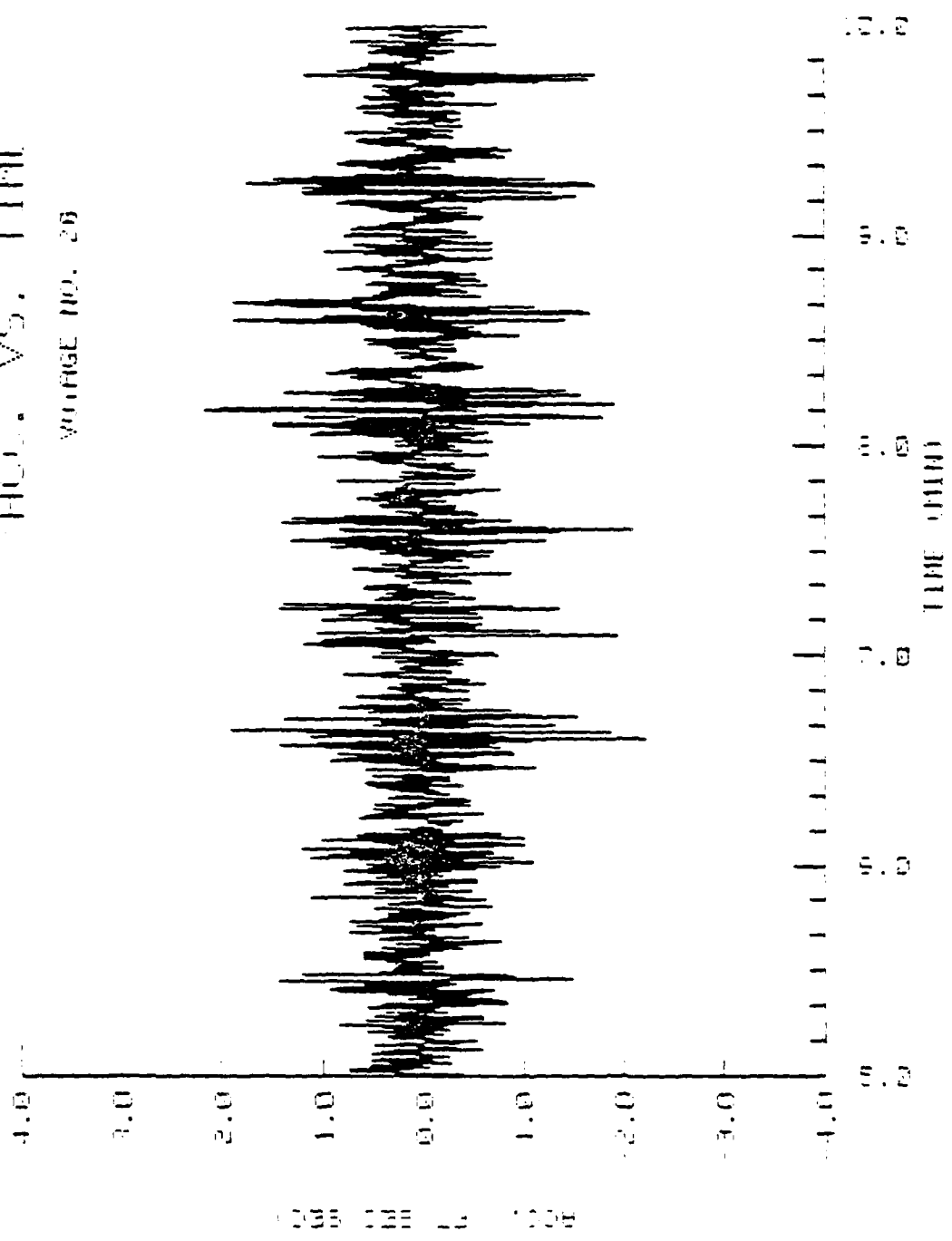




FIG. VS. TIME

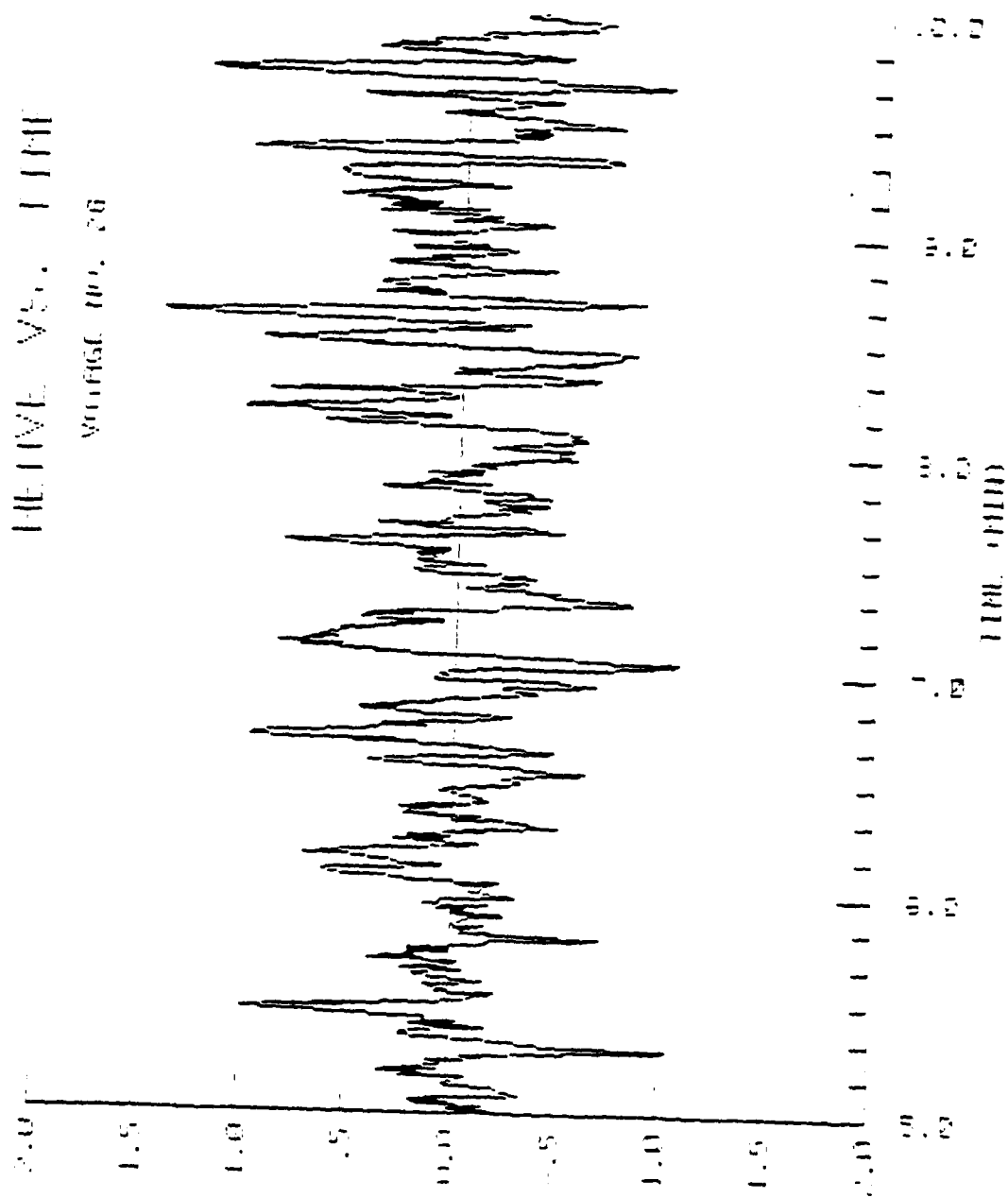
VOLUME NO. 25





HEIWE V5. 1111

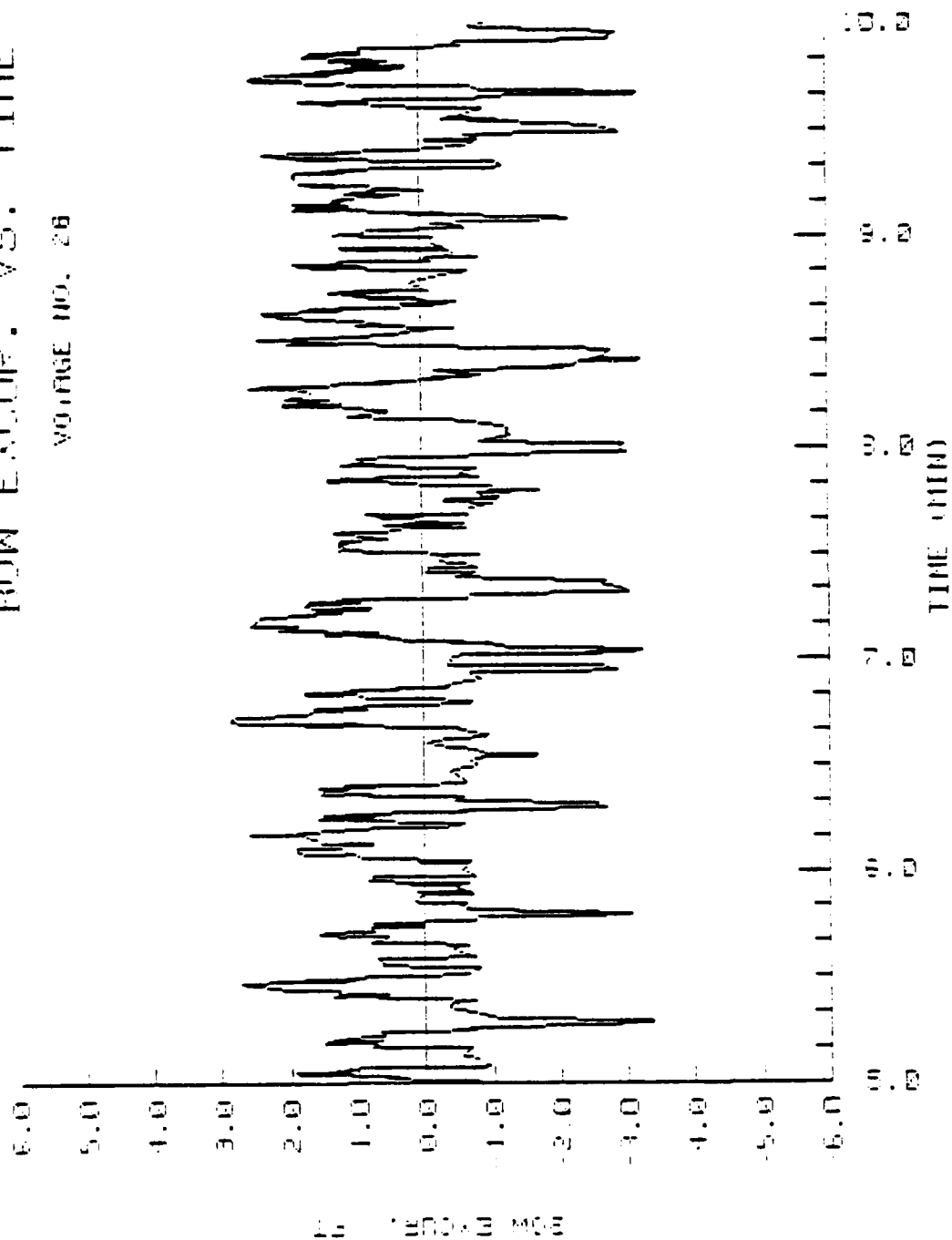
YOUNG 100. 26





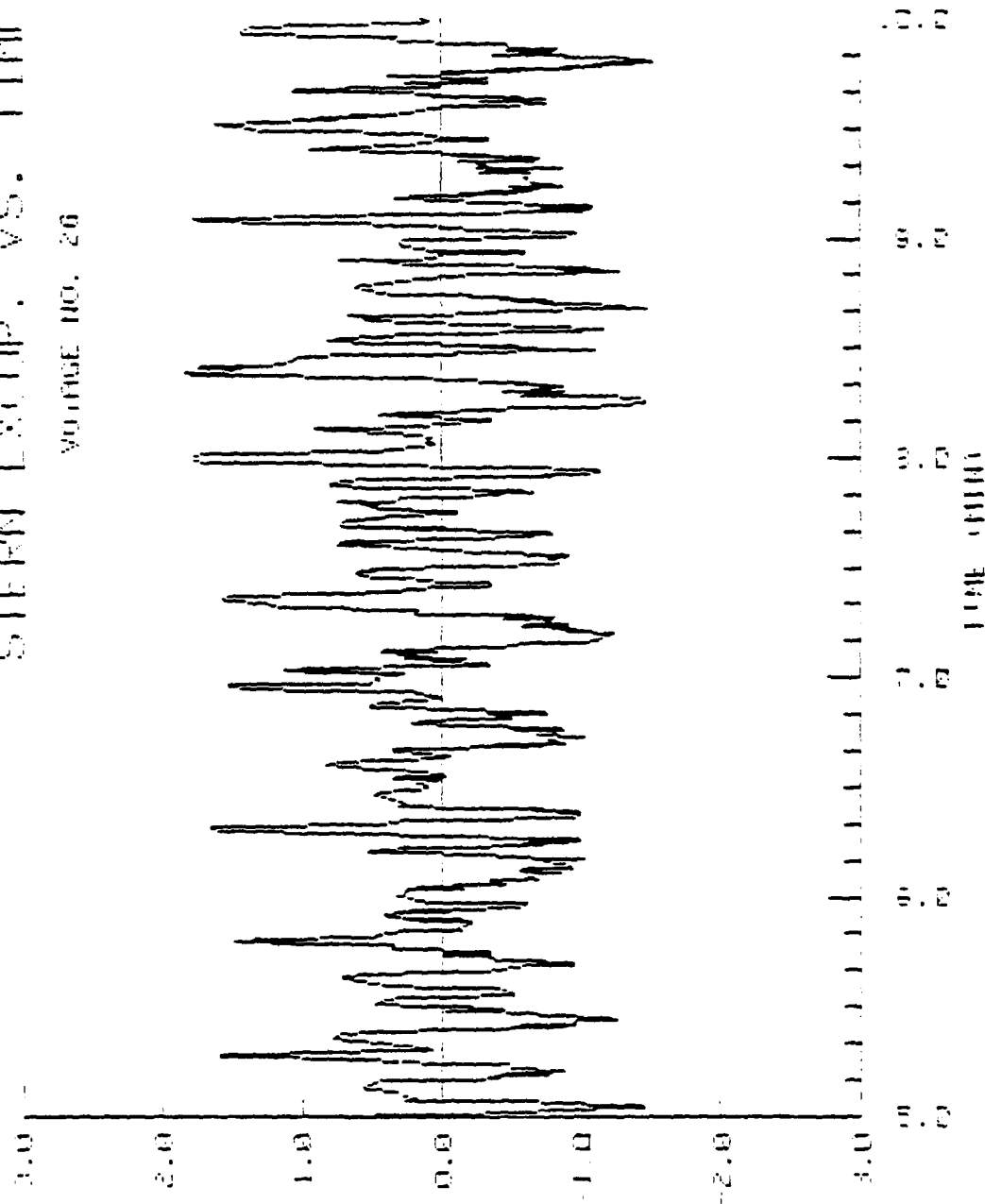
# ROW EXCUR. VS. TIME

VOLUME NO. 28





# STERN EXCIP. VS. TIME VOYAGE NO. 26

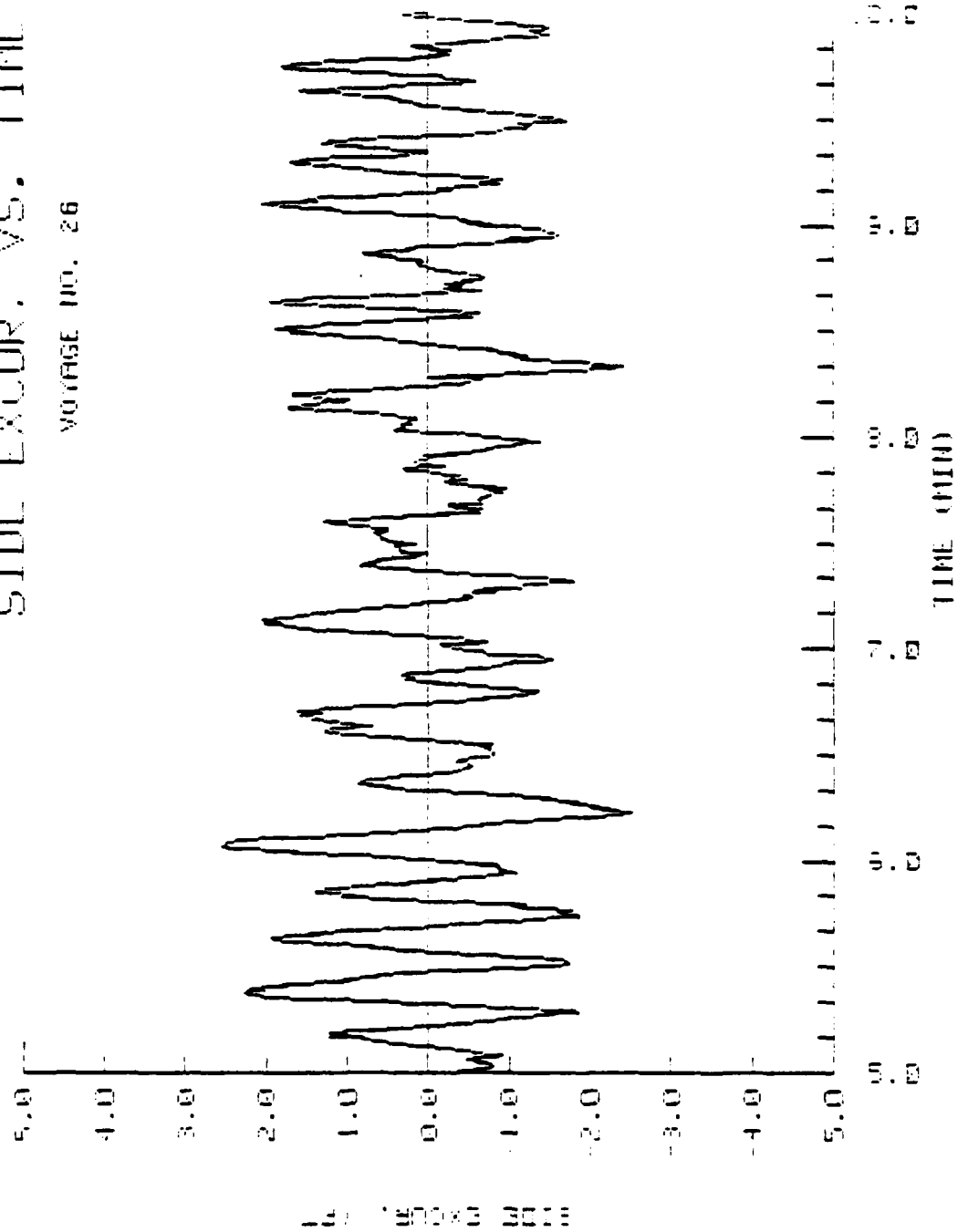


STERN EXCIP. VS. TIME



# SIDE EXCUR. VS. TIME

VOYAGE NO. 26





# STATISTICAL SUMMARY

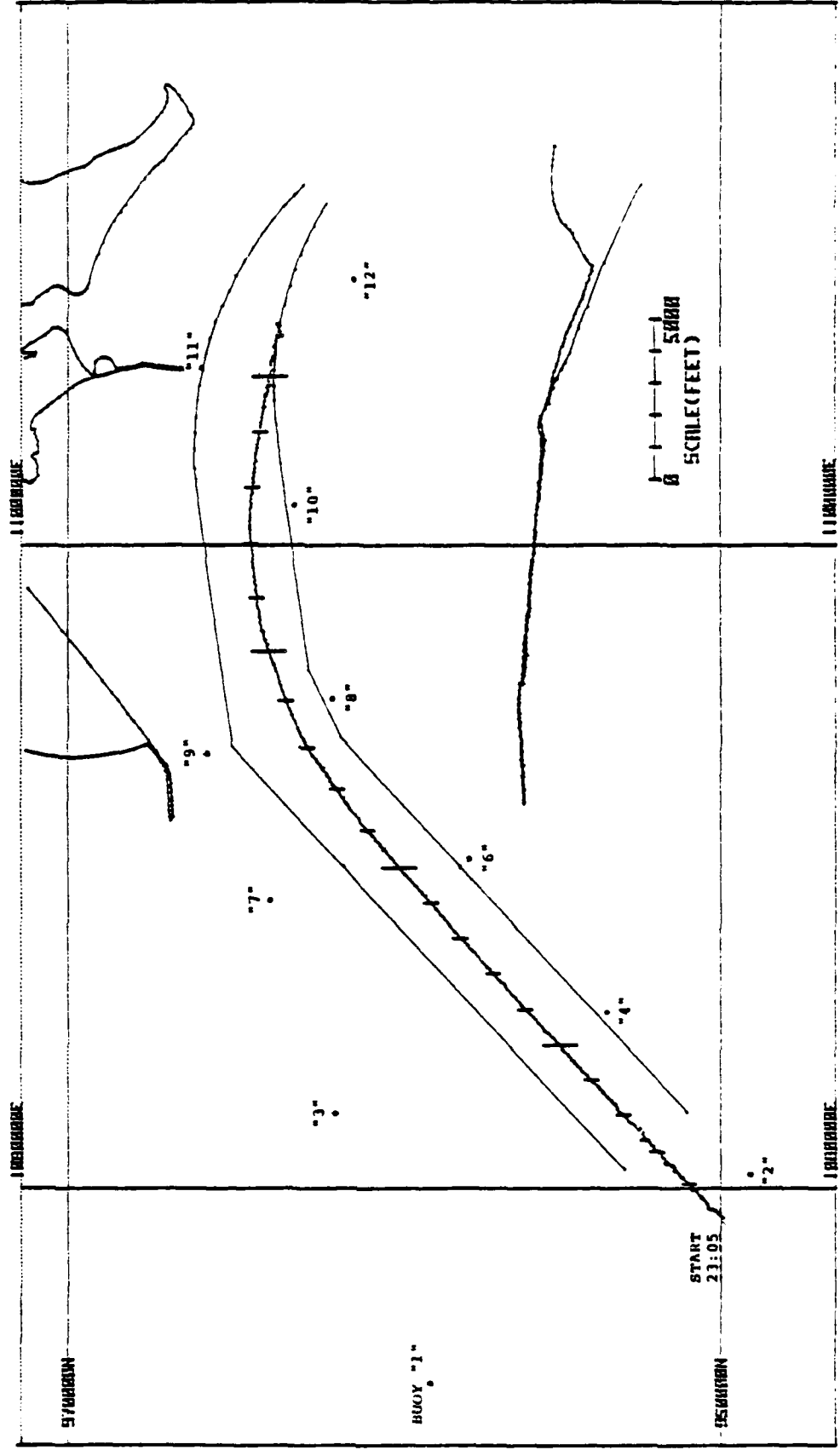
VOTAGE NO. 27

	HEAD LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	-1.9	.9	.5	.5
ROLL (DEG)	-1.1	5.4	2.2	2.5
YOC (FT/SEC/SEC)	.0	1.6	.6	.7
HEAVE (FT)	.0	1.9	.9	1.0
ROLL EXCUR. (FT)	.0	7.2	3.0	3.5
SHIP EXCUR. (FT)	.1	3.7	1.6	1.8
SIDE EXCUR (FT)	.0	5.8	2.0	2.3



# VOYAGE NO. 27 SHIP TRACK

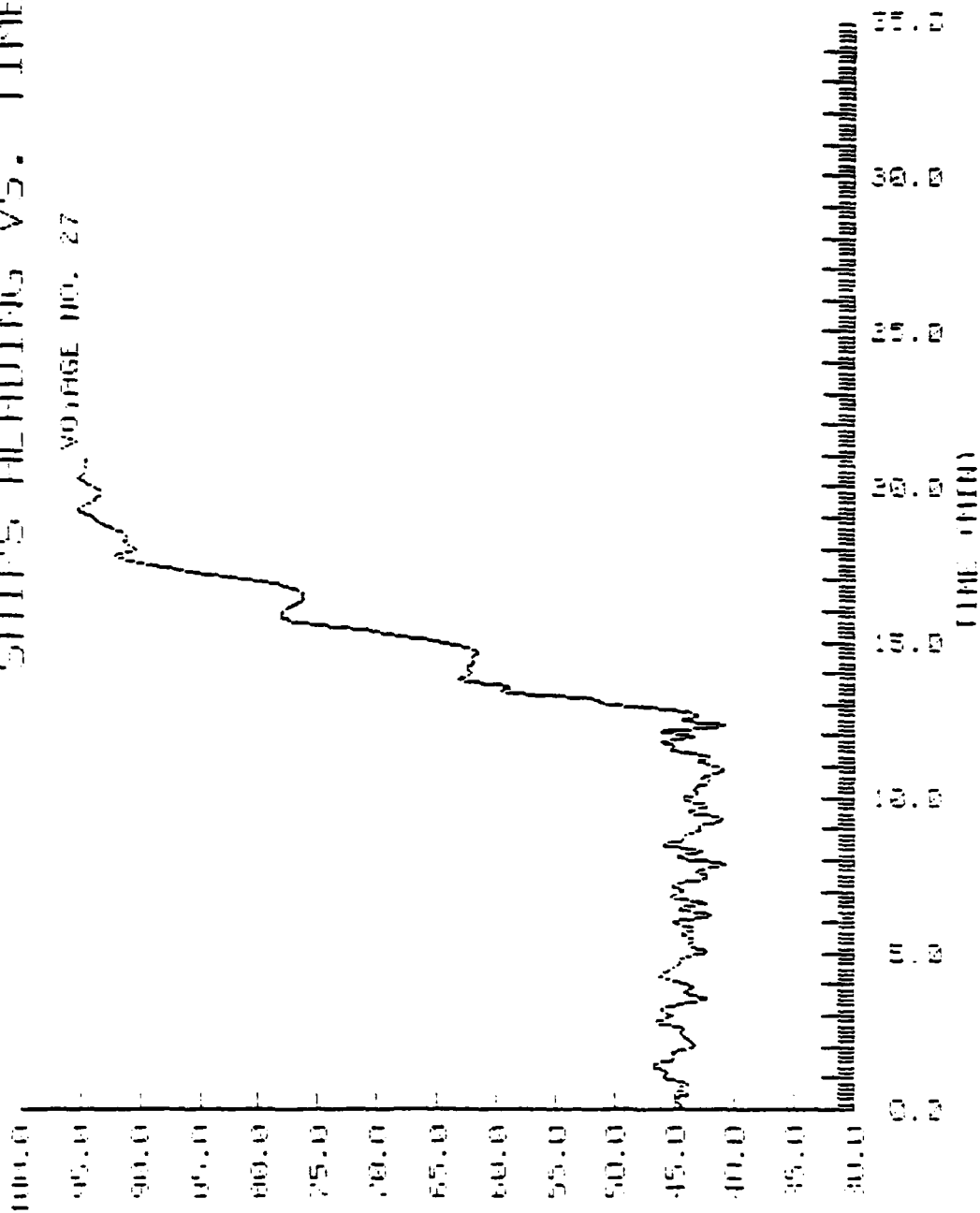
SCALE 1" = 3000'





# SHIPS HEADING VS. TIME

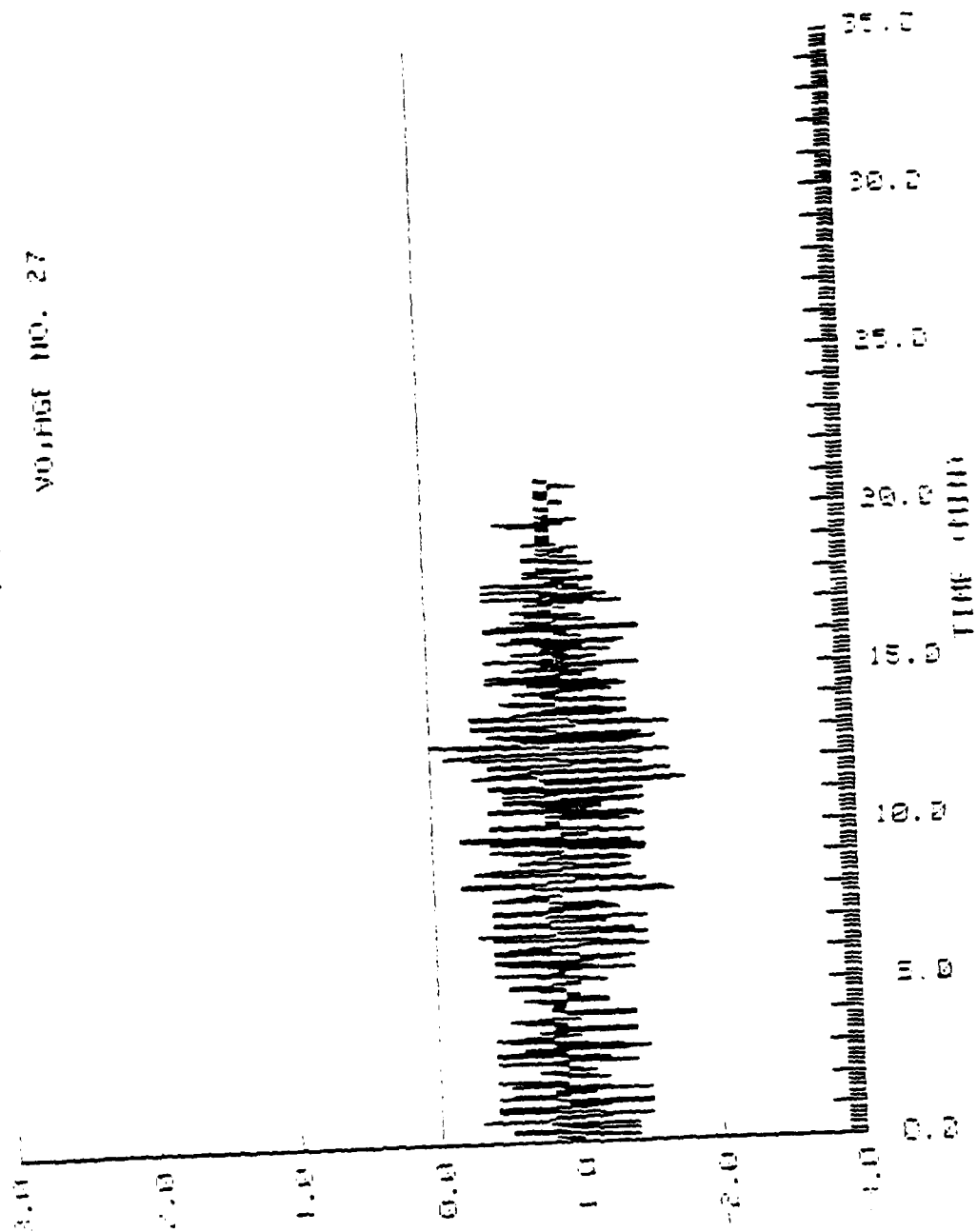
VOLUME NO. 27





# PITCH VS. TIME

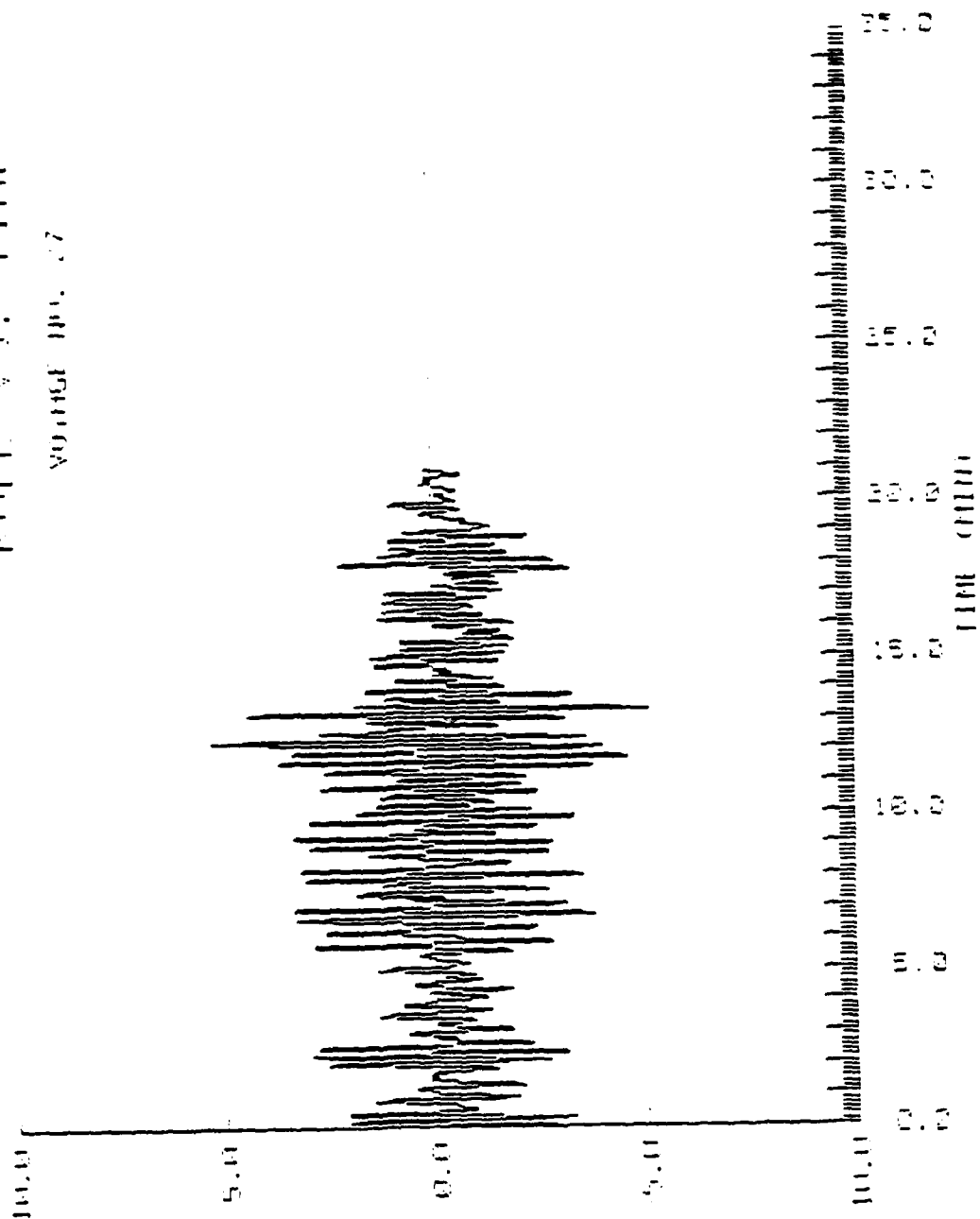
VOICED NO. 27





POLY. V. 1111

VOLUME 100. 27

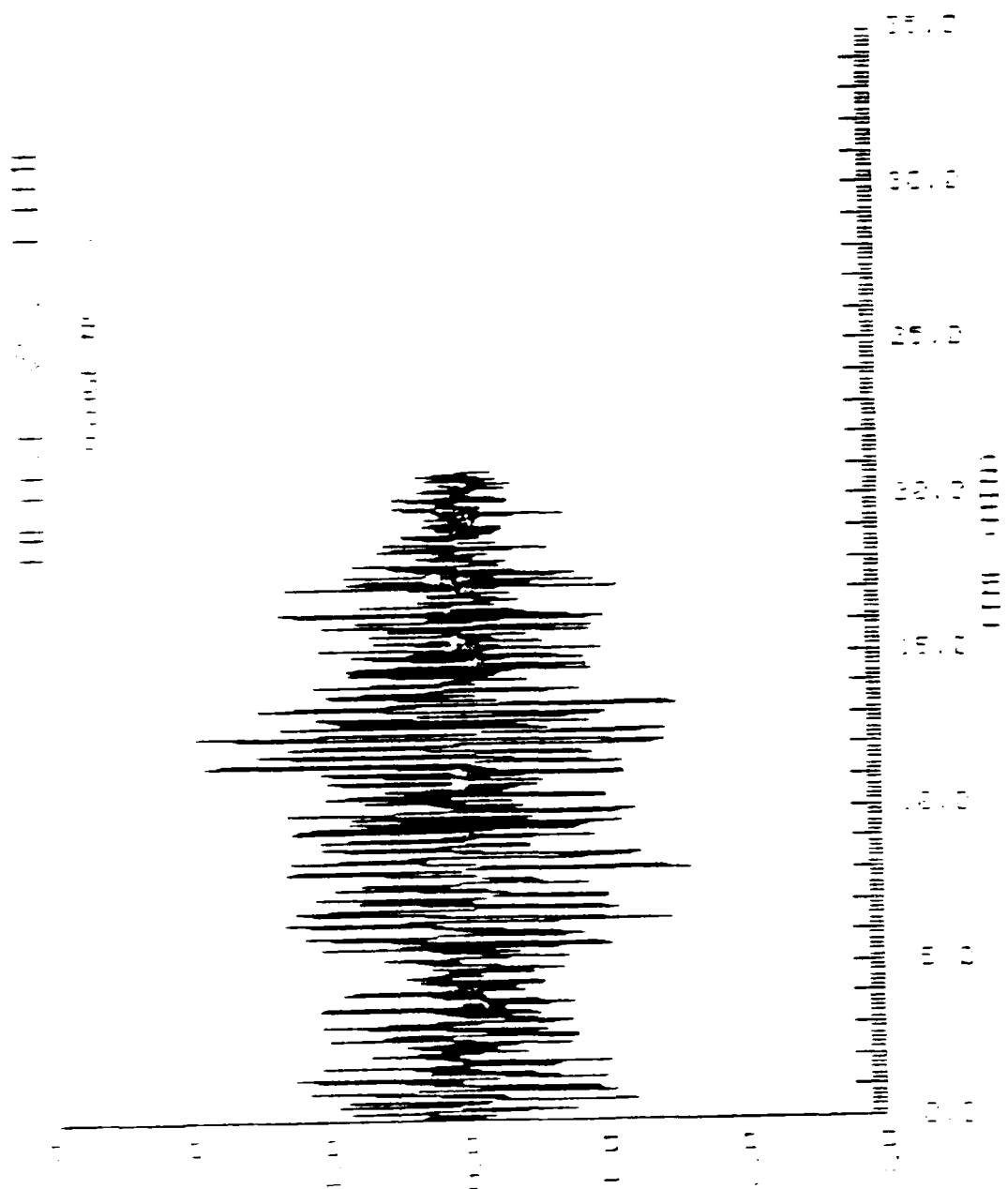


100.0 50.0 0.0 50.0 100.0

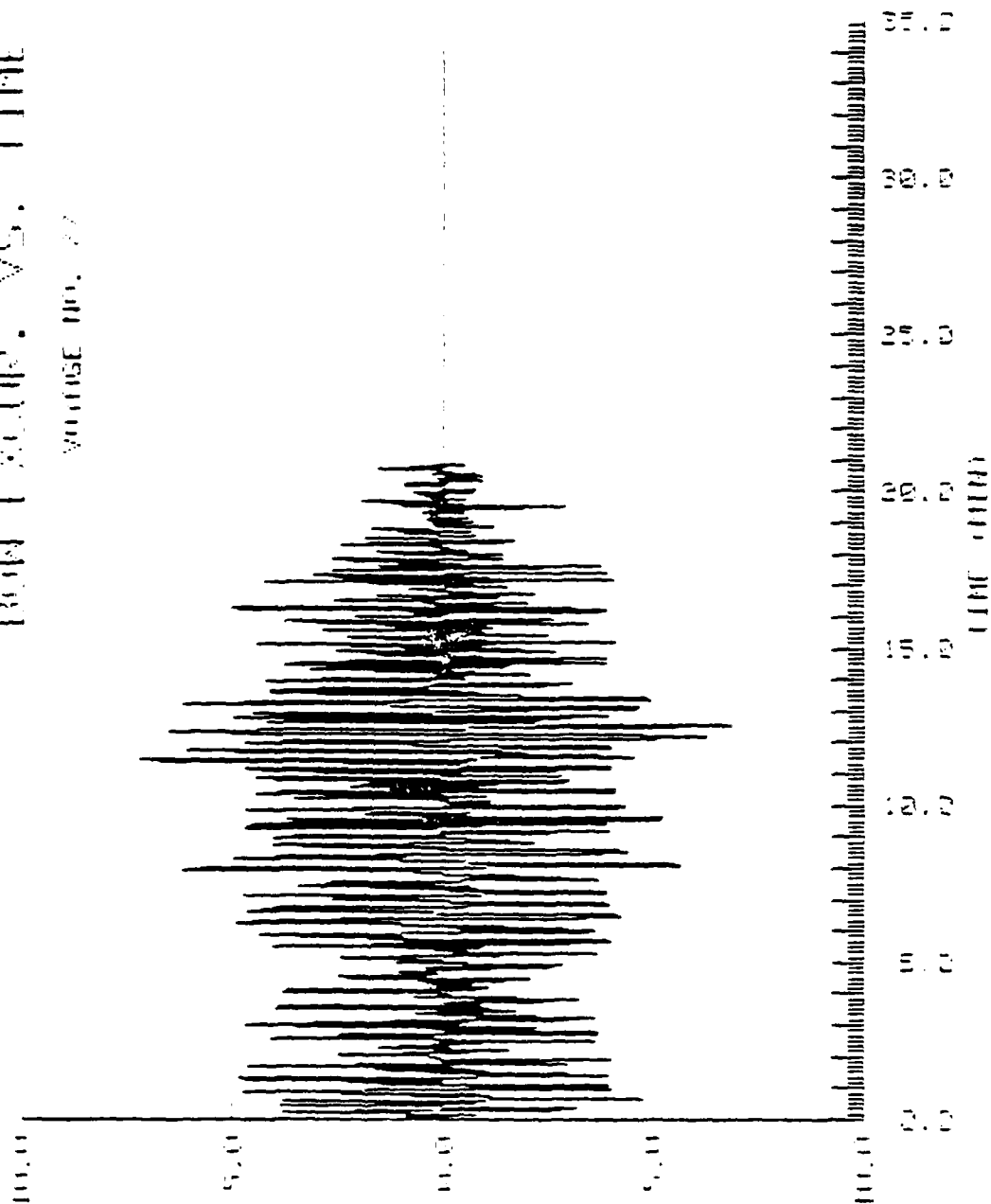






[illegible]

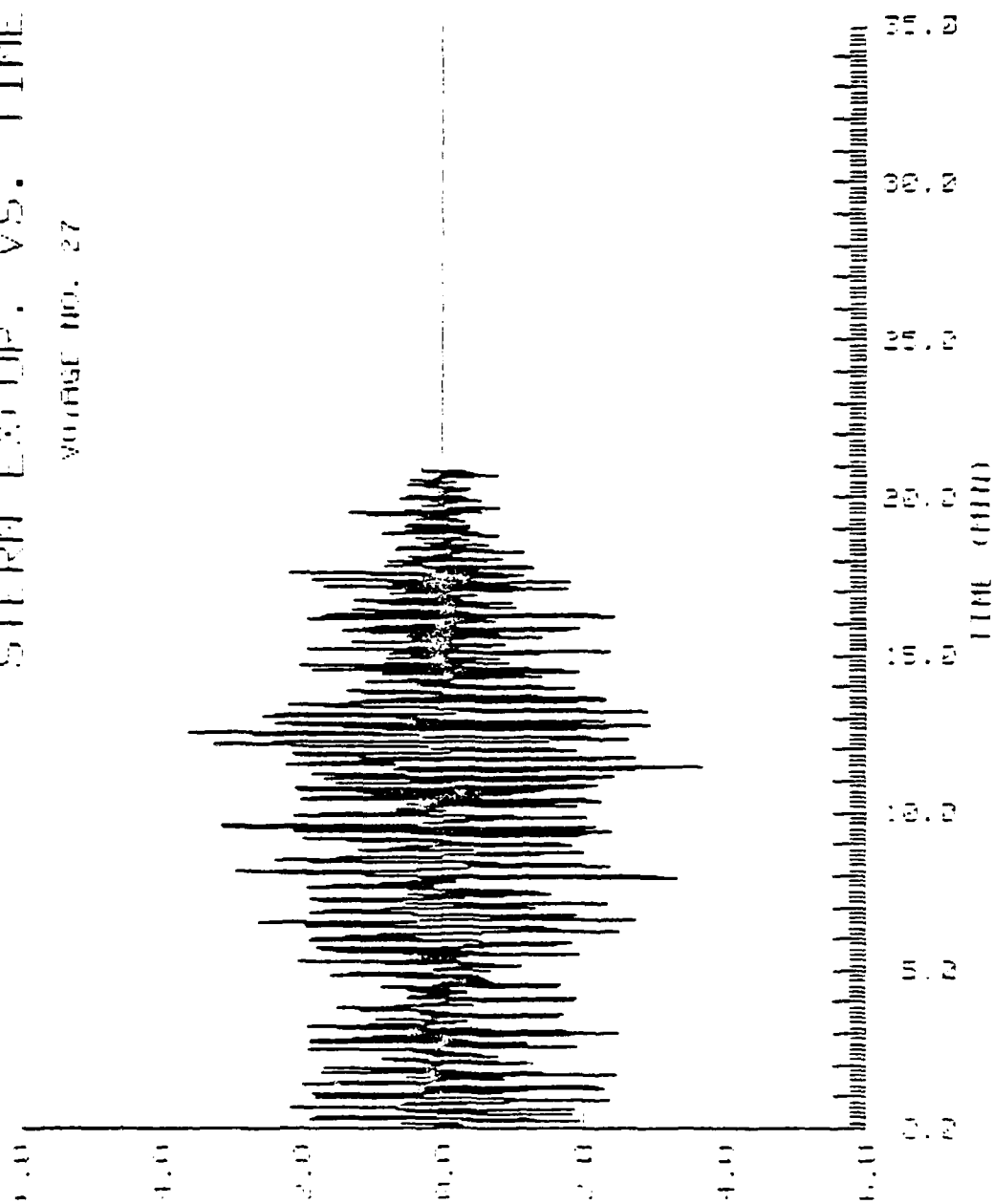


[illegible]



# STERN EXDIP. VS. TIME

VOLUME NO. 27

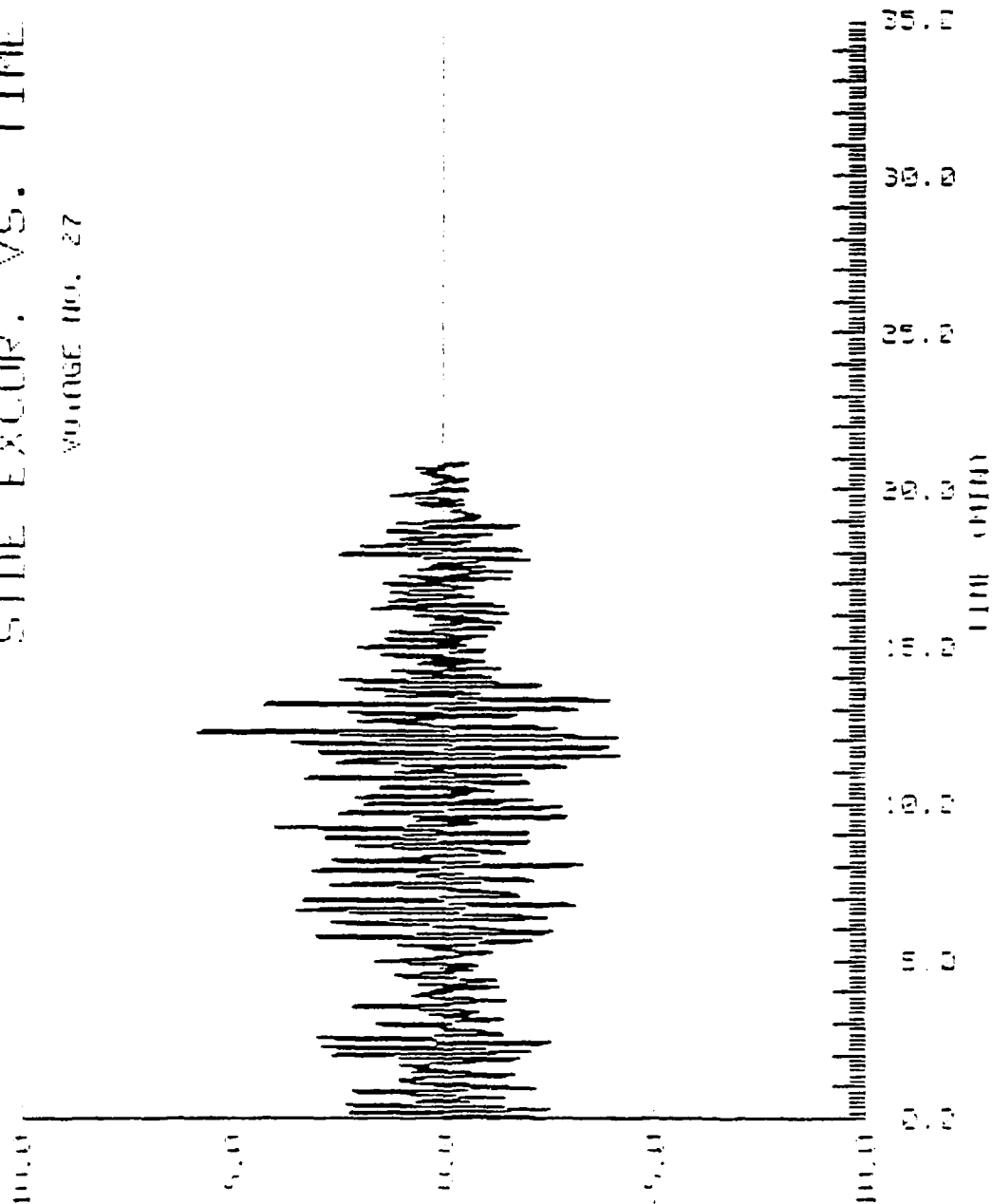


11-18-1963



# SIDE EXCUR. VS. TIME

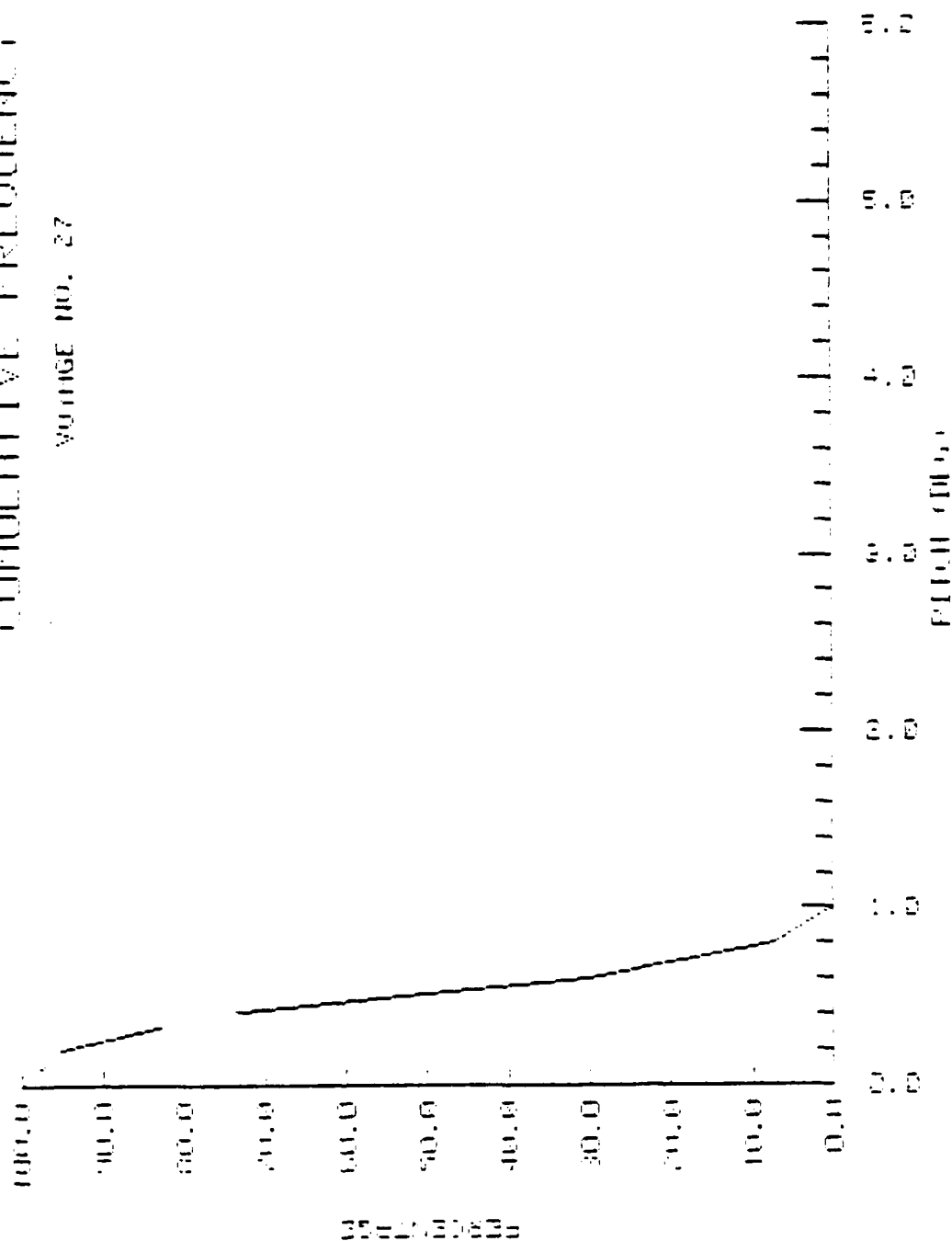
VOLUME NO. 27





# CUMULATIVE FREQUENCY

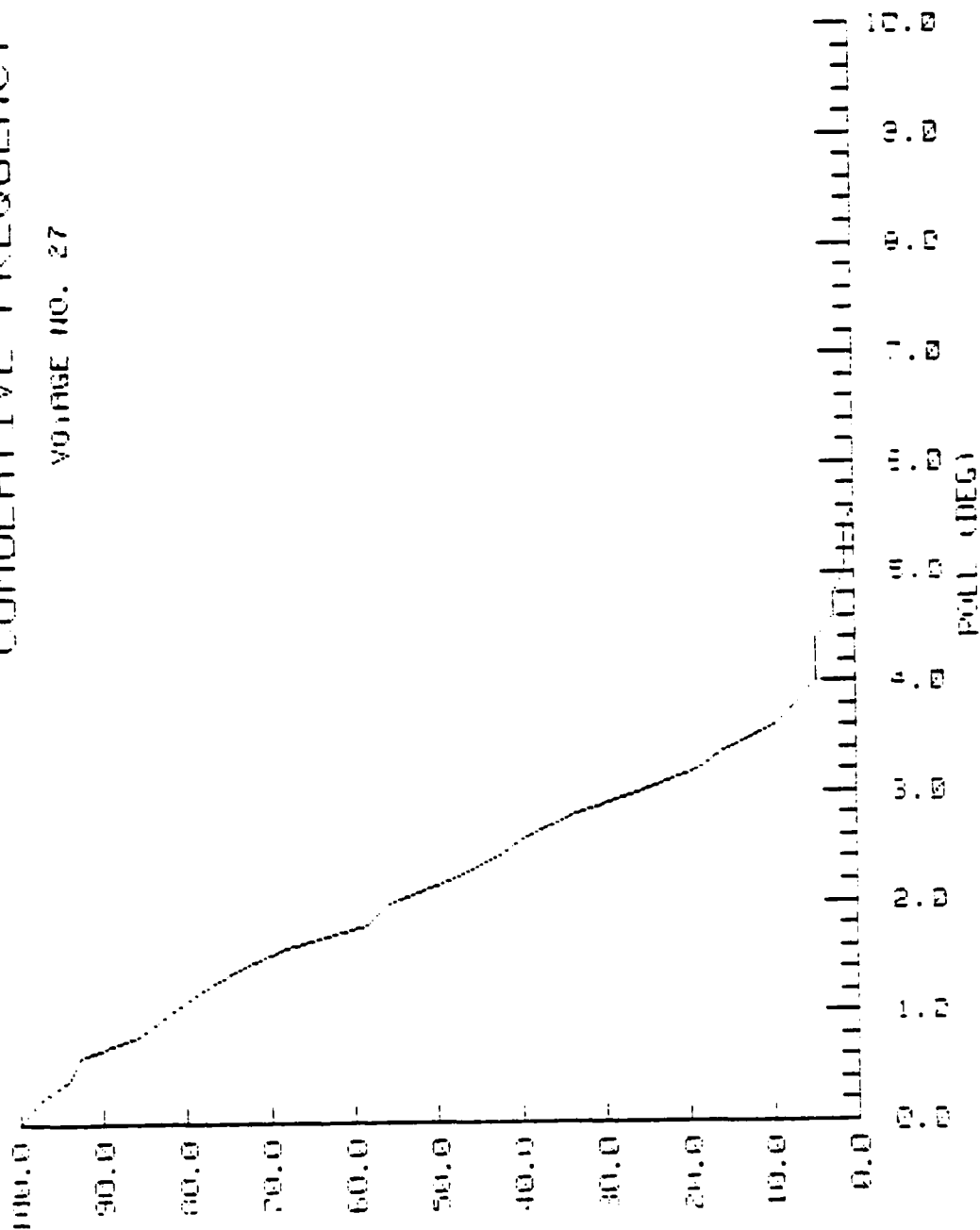
WING NO. 27





# CUMULATIVE FREQUENCY

VOLUME NO. 27

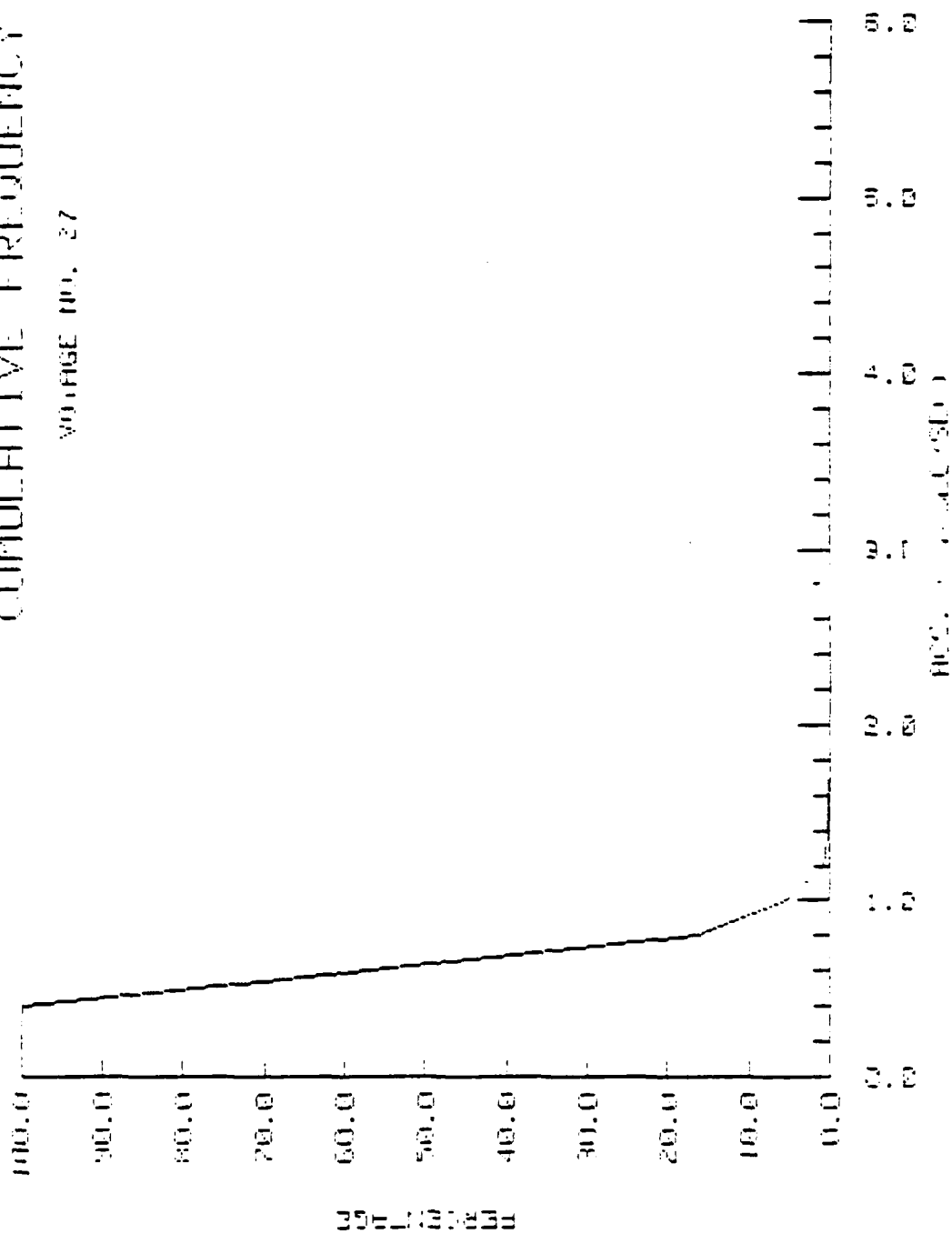


352-NB0858



# CUMULATIVE FREQUENCY

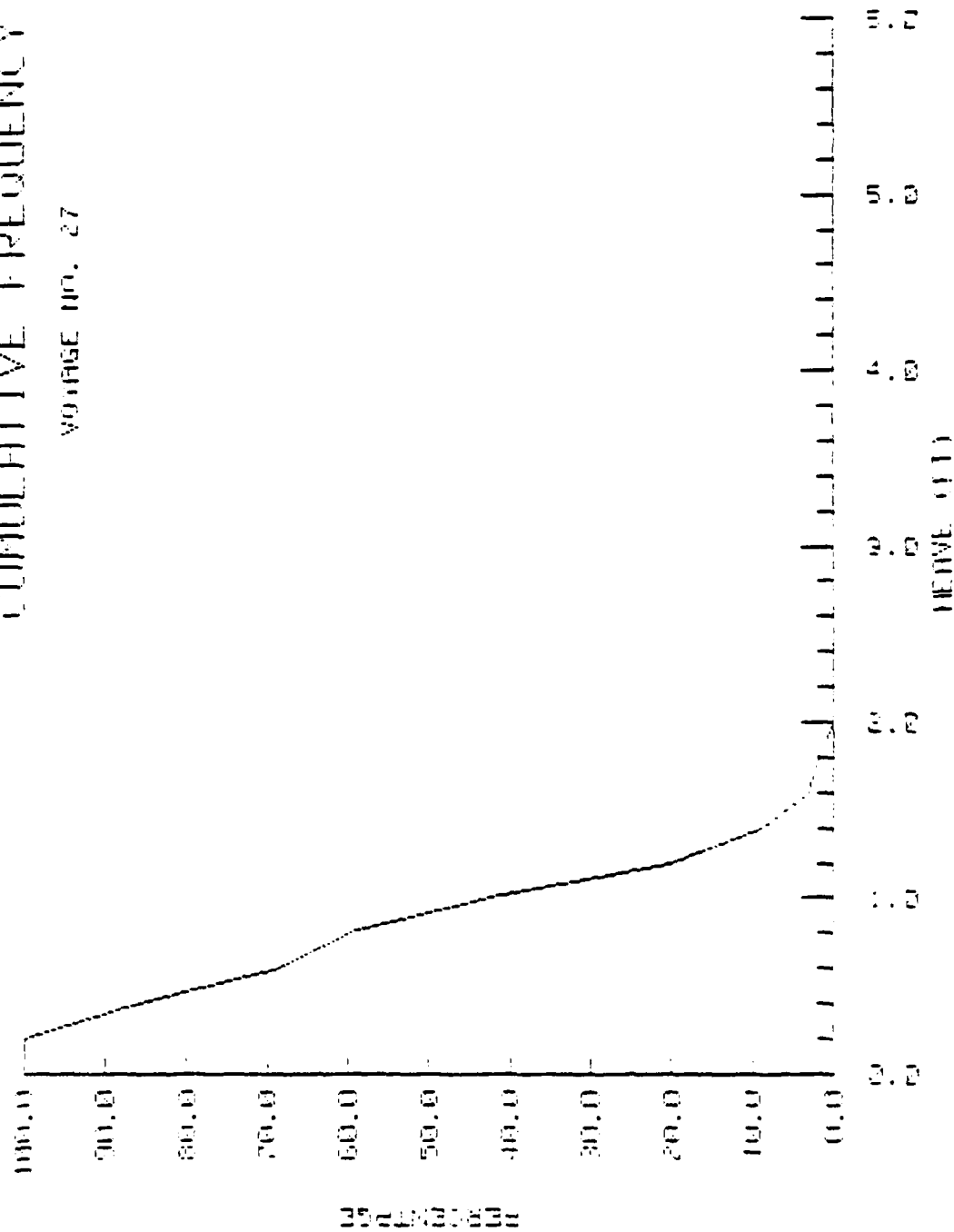
VOLUME NO. 27





# CUMULATIVE FREQUENCY

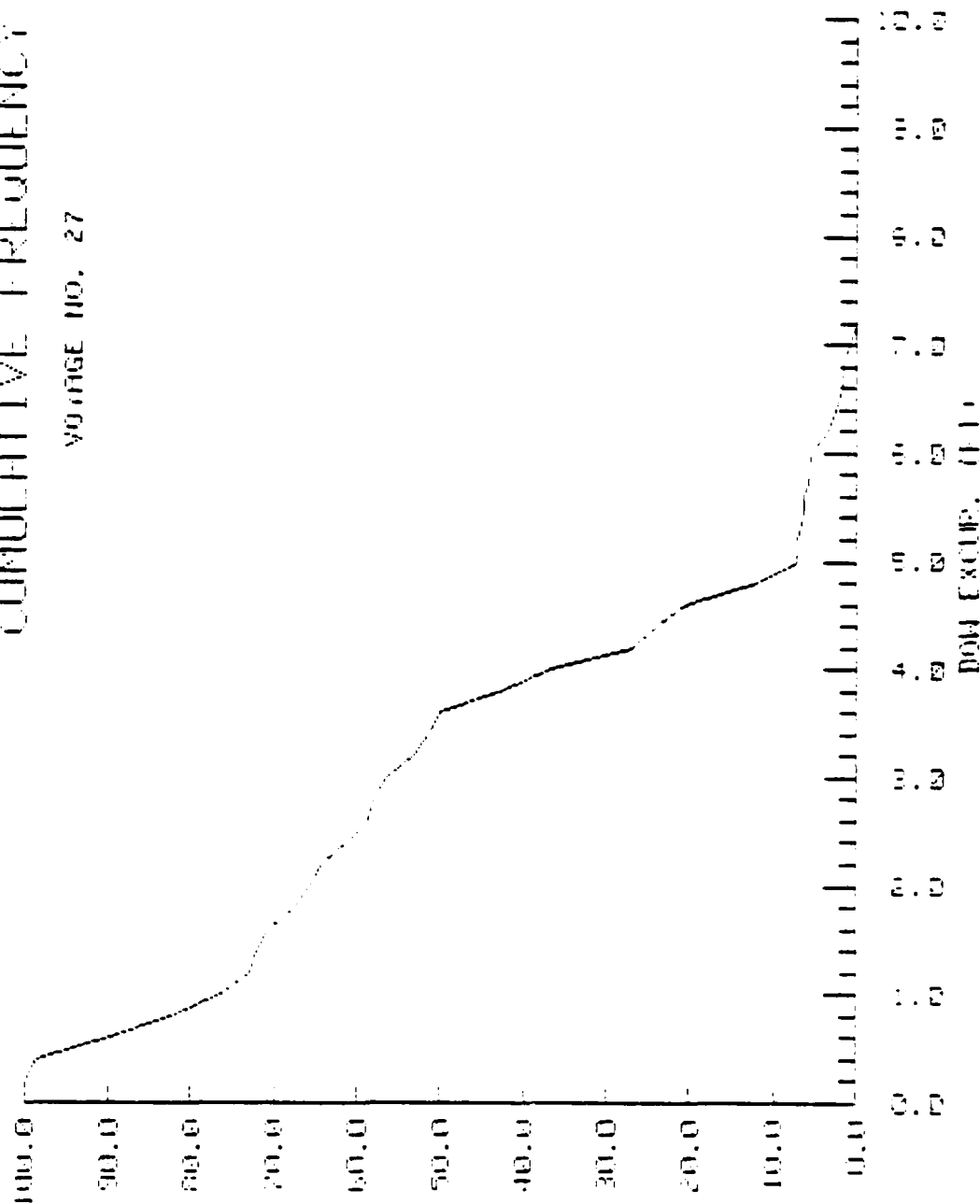
VOLAGE NO. 27





# CUMULATIVE FREQUENCY

VOLUME NO. 27

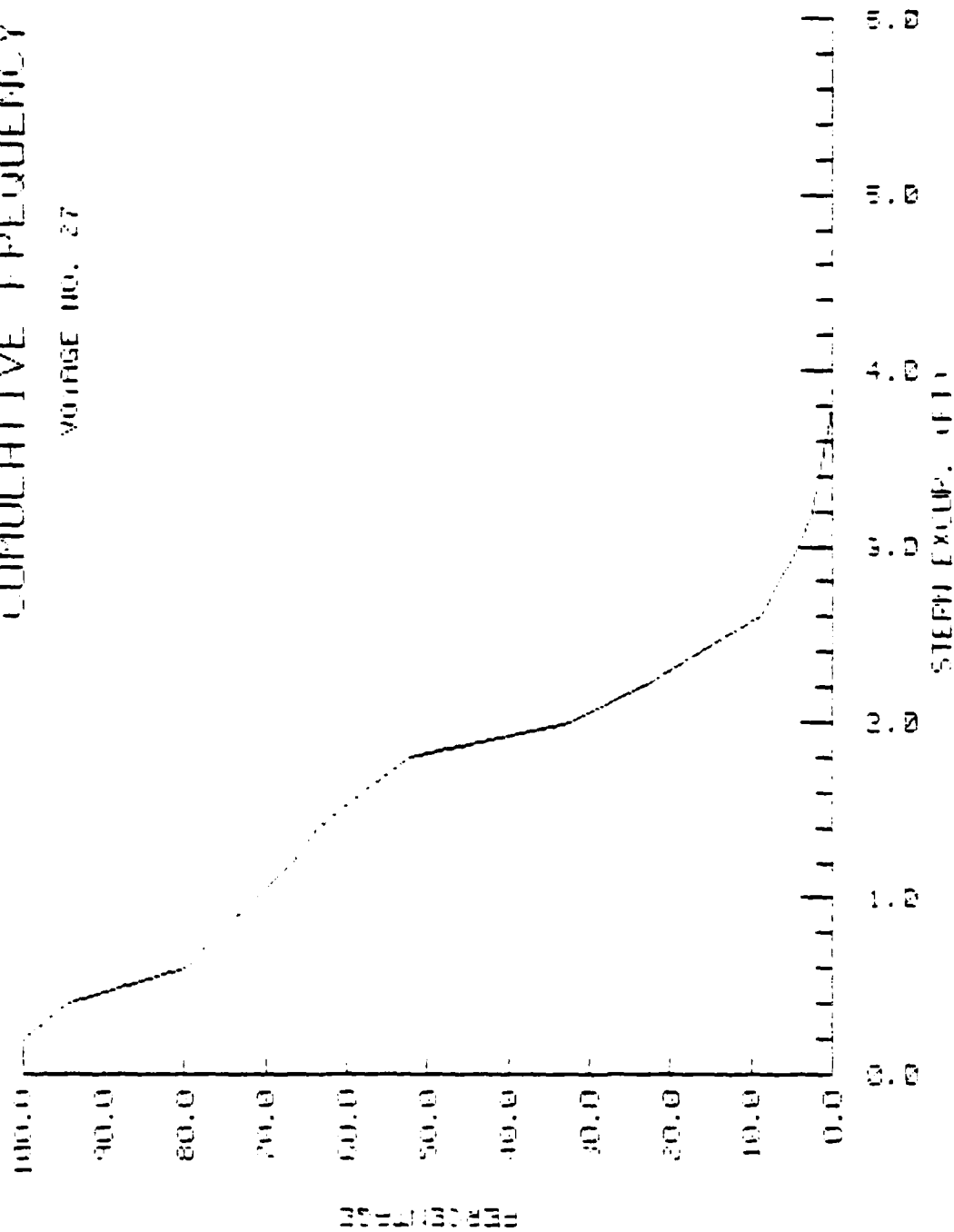


25-12-20-11



# CUMULATIVE FREQUENCY

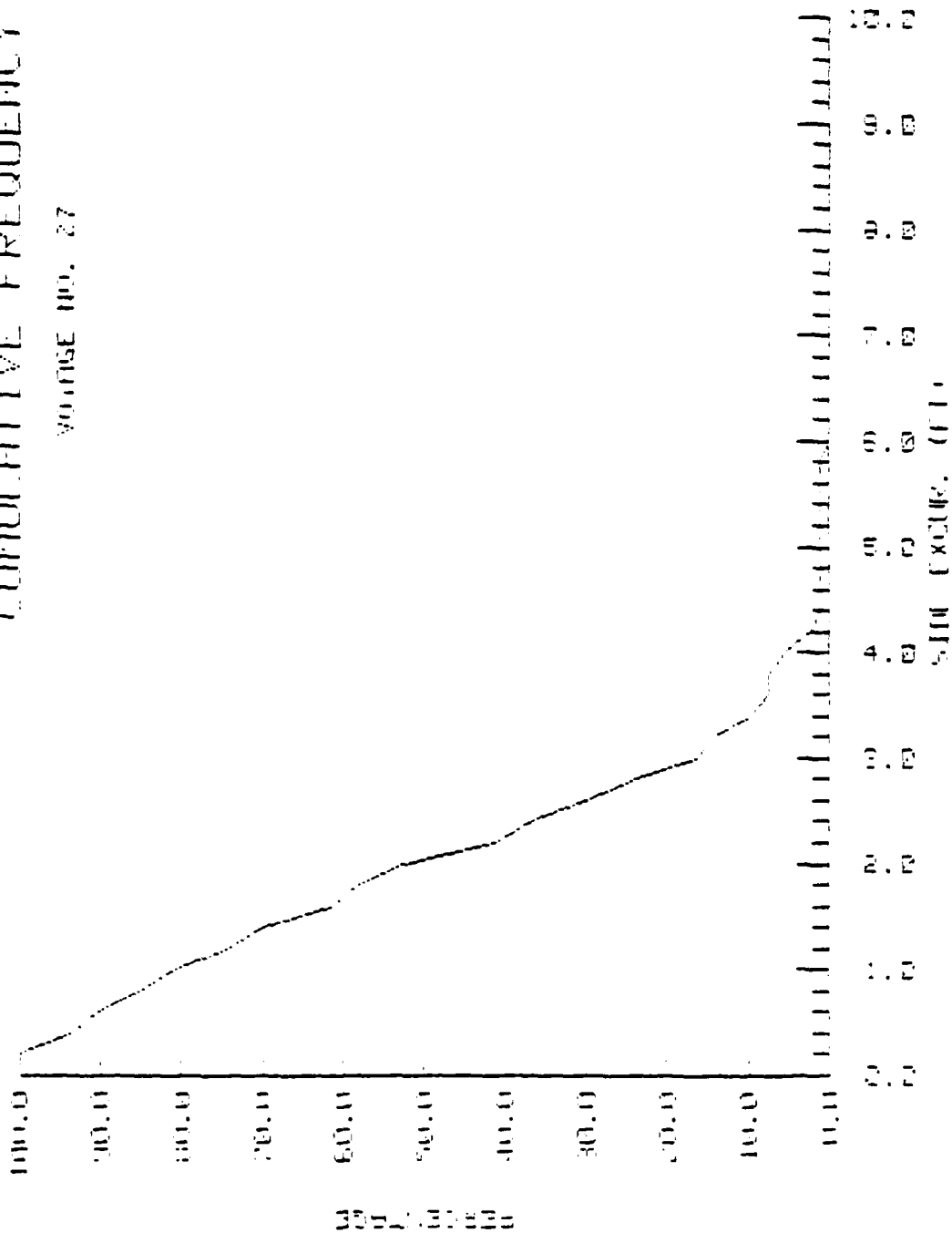
VOLUME NO. 27





# CUMULATIVE FREQUENCY

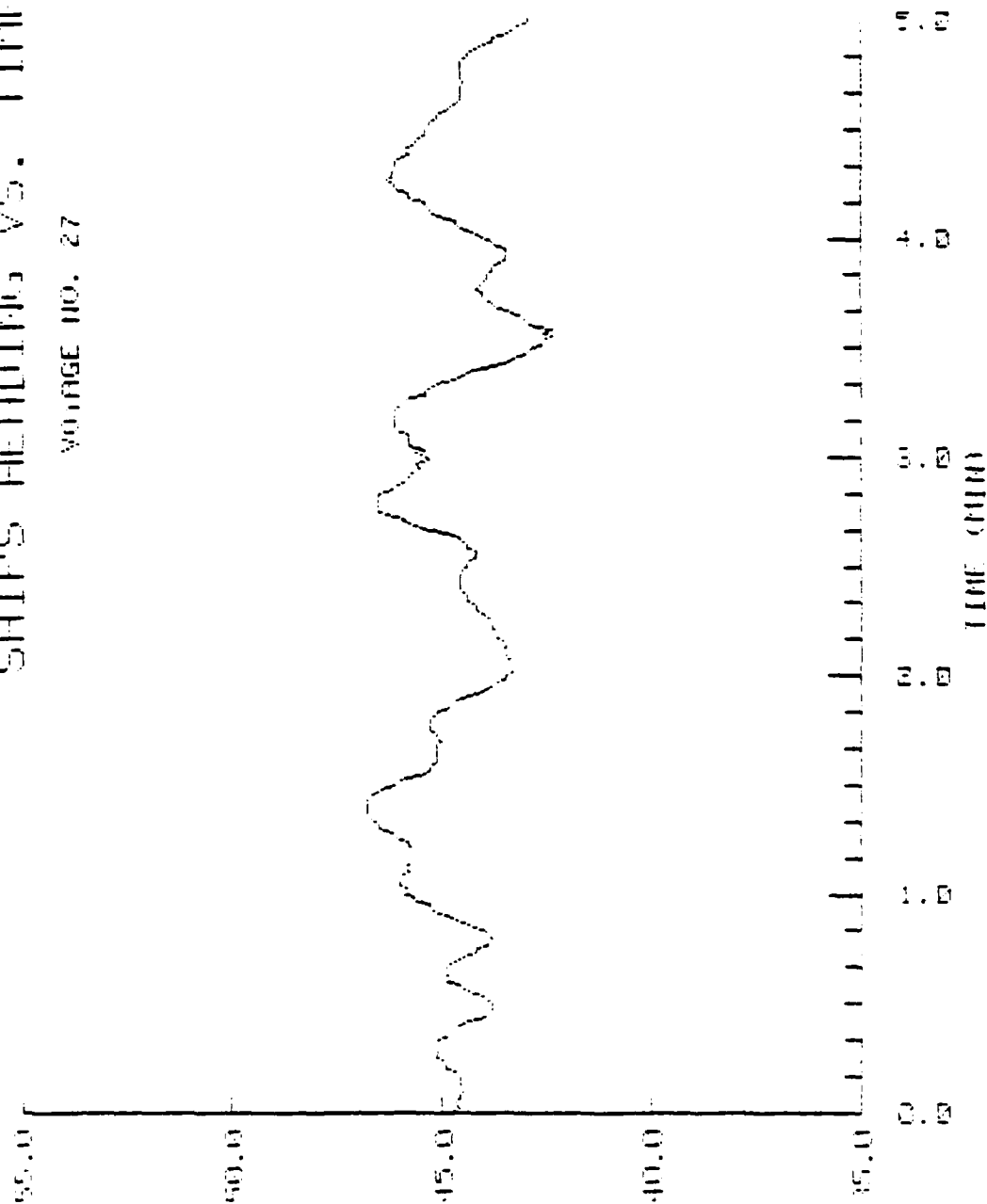
VOICE NO. 27





# SHIPS HEADING VS. TAIL

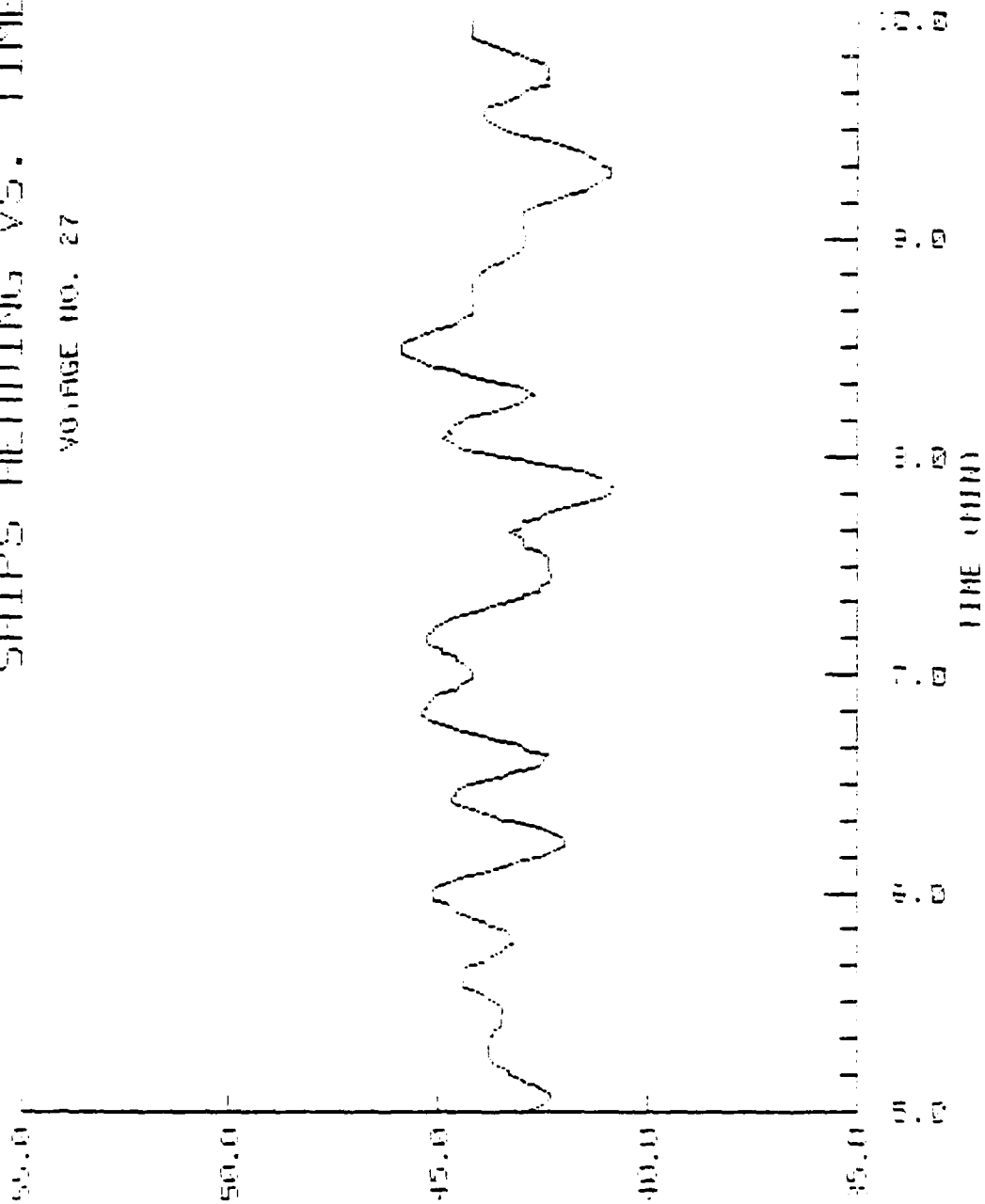
NO. PAGE NO. 27





# SHIPS HEADING VS. TIME

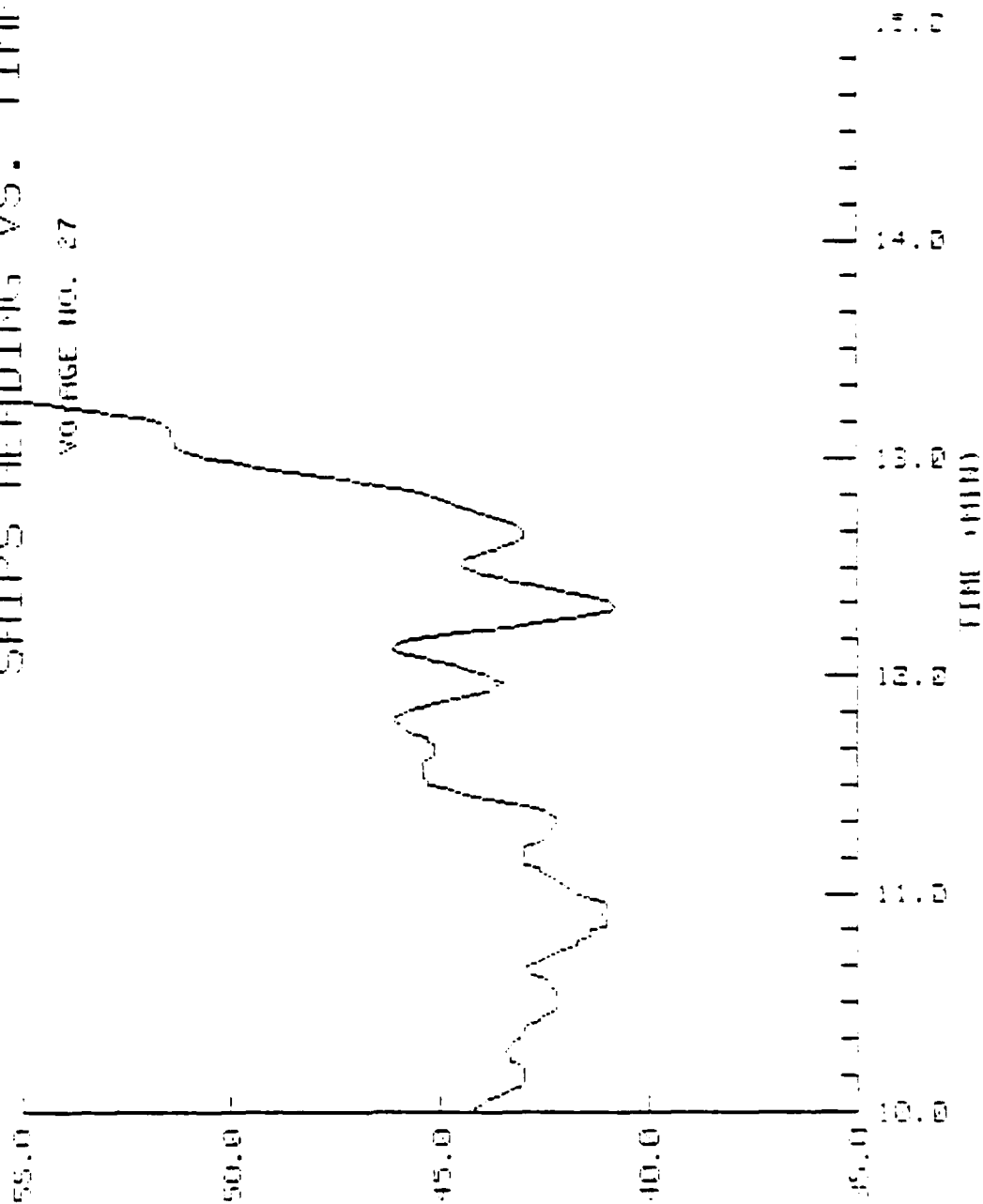
VOLUME NO. 27





# SHIPS HEADING VS. TIME

VOLUME NO. 27

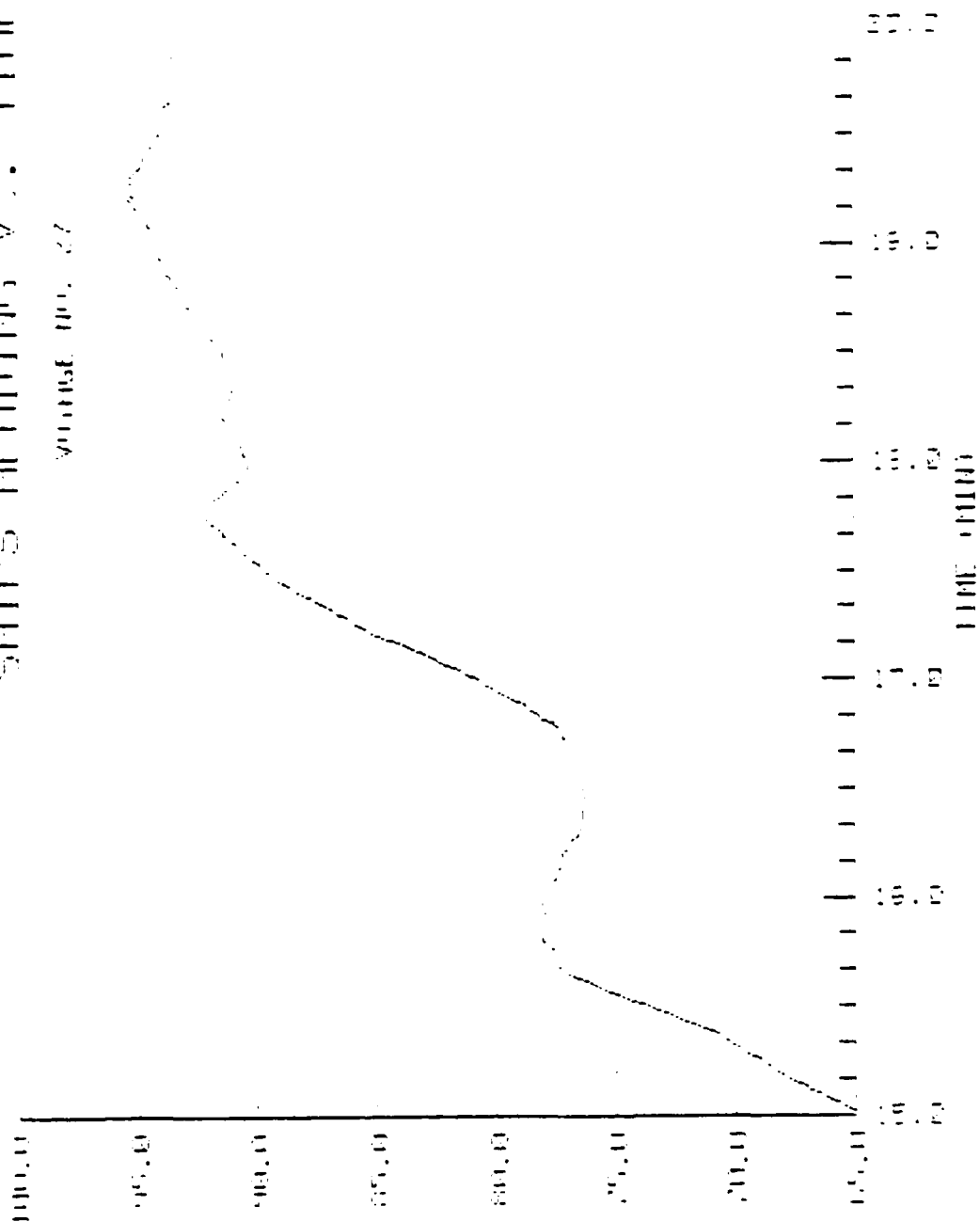


100 : 2400:34 3-1-78



# SHIPS HULLING V.S. TIME

WINDAGE NO. 27

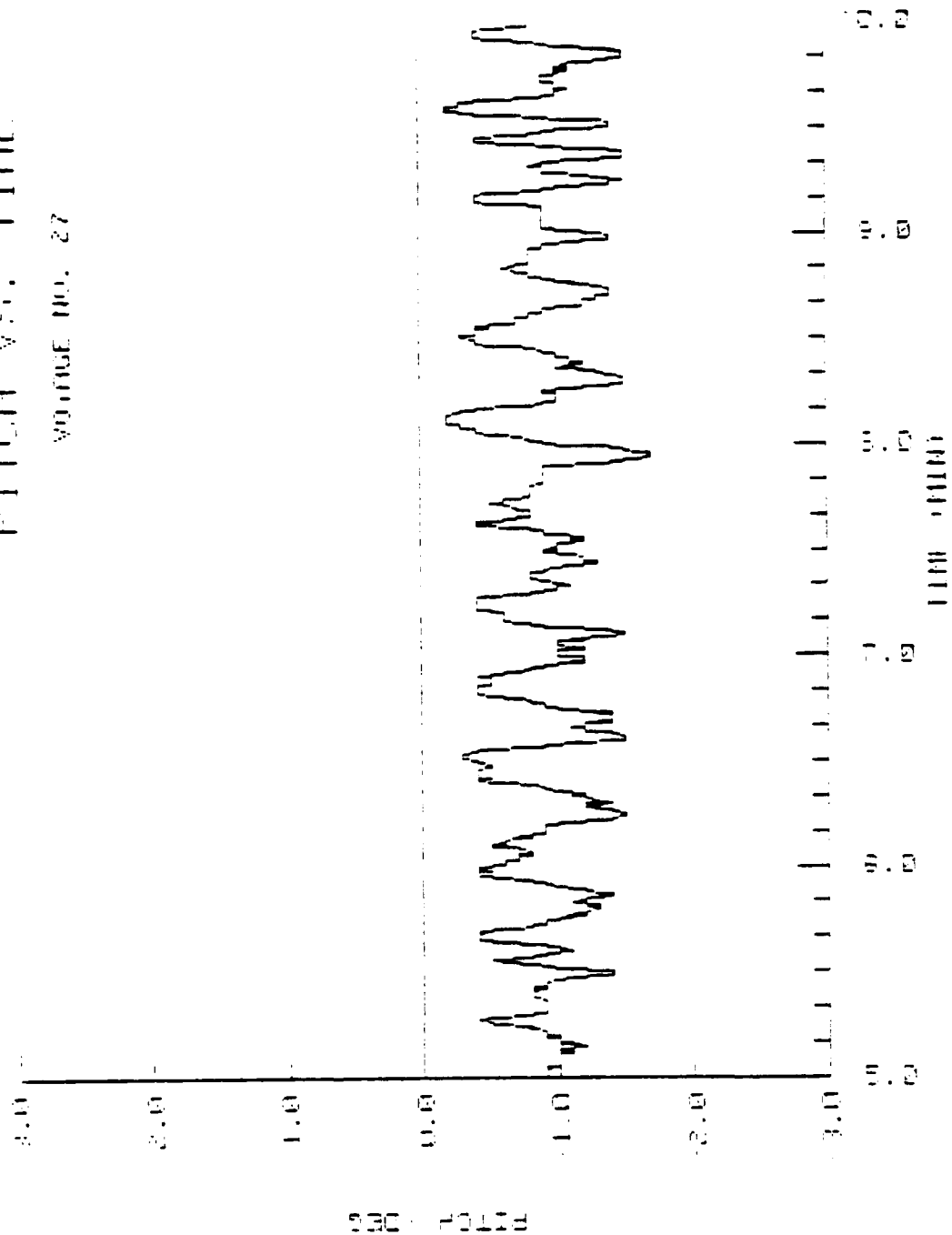


100.00 95.00 90.00 85.00 80.00 75.00 70.00 65.00 60.00 55.00 50.00 45.00 40.00 35.00 30.00 25.00 20.00 15.00 10.00 5.00 0.00



# PITCH VS. TIME

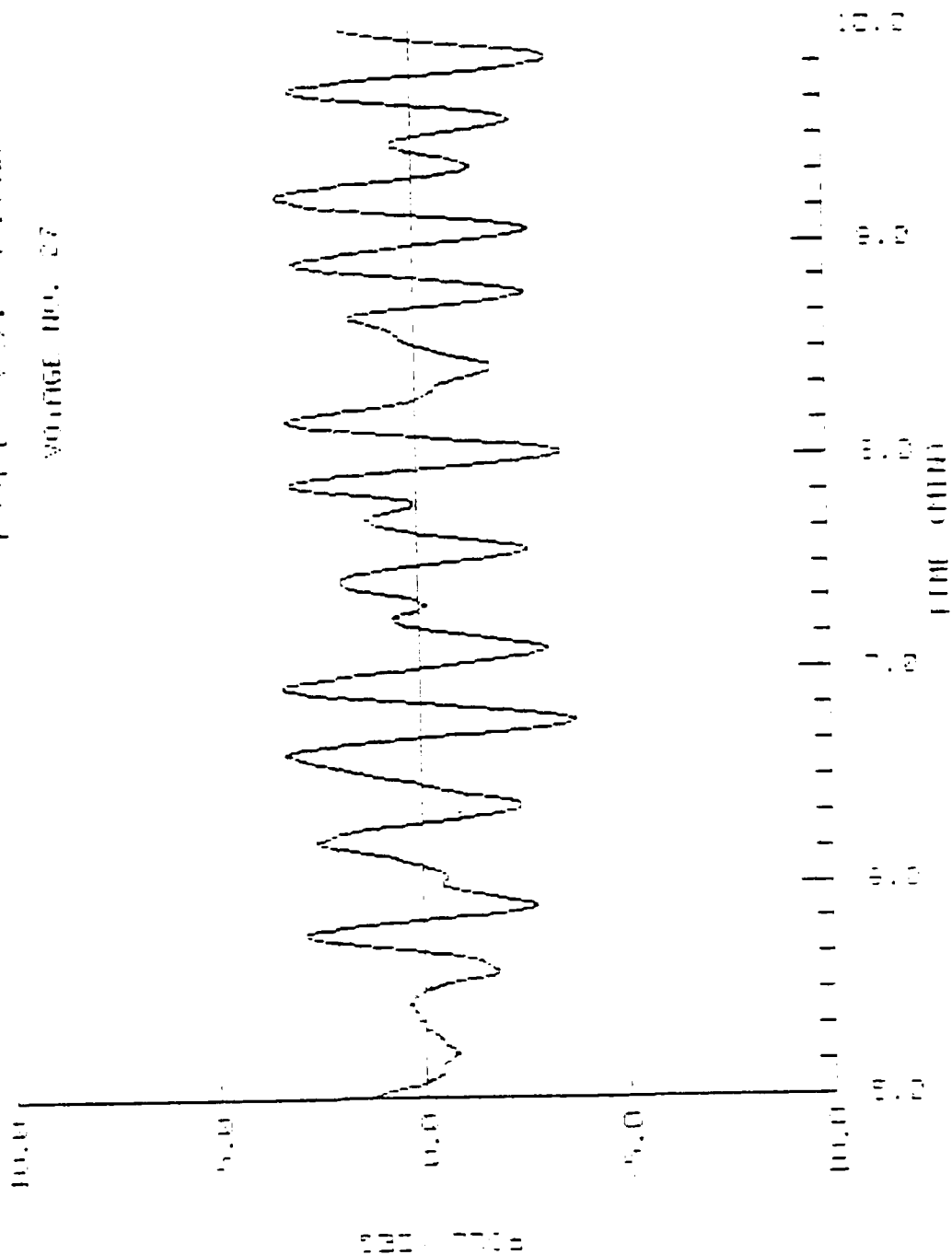
VOLUME NO. 27





Potential vs. Time

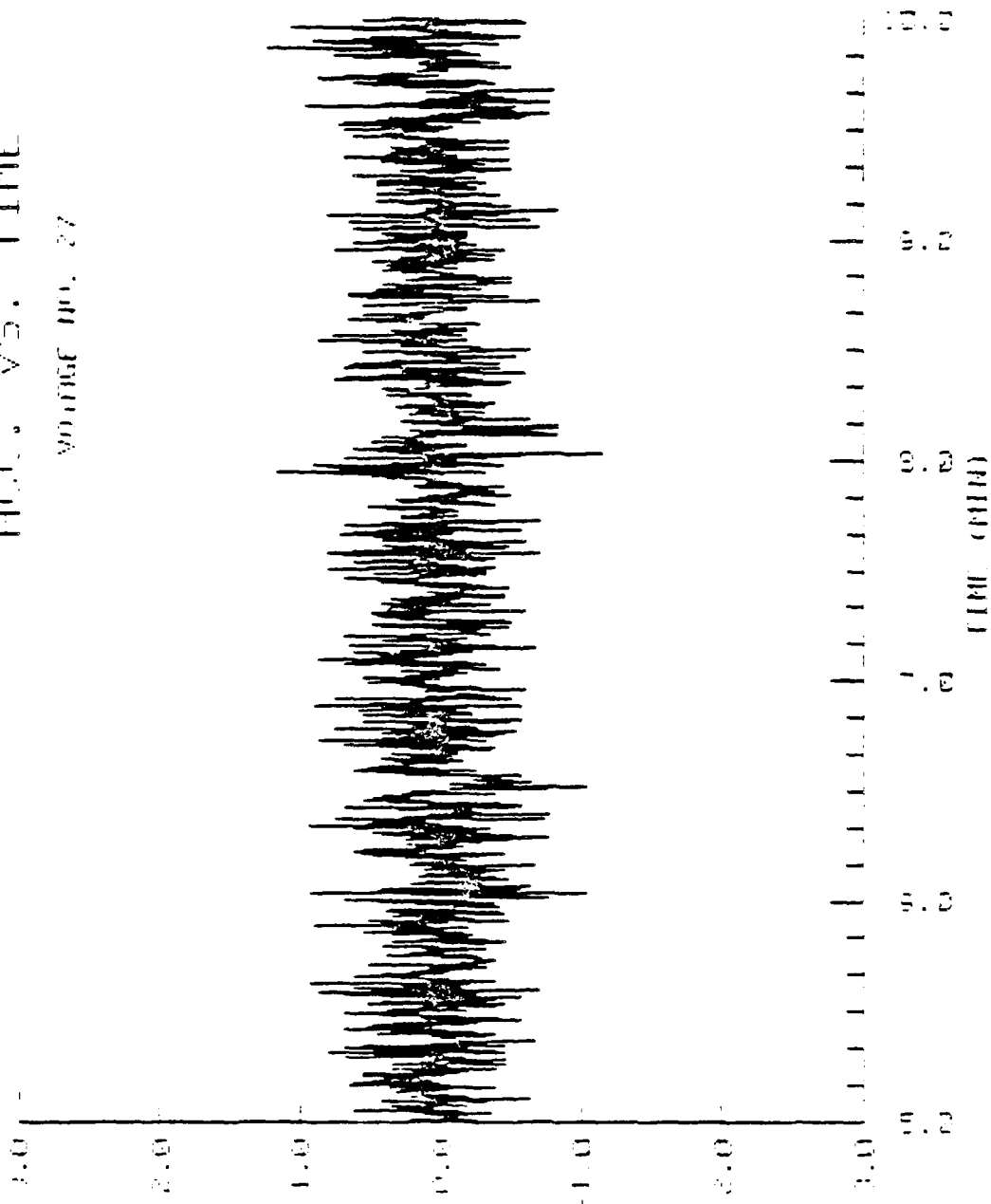
Y-axis: Volts





HCC. VS. TIME

YOUNG NO. 27

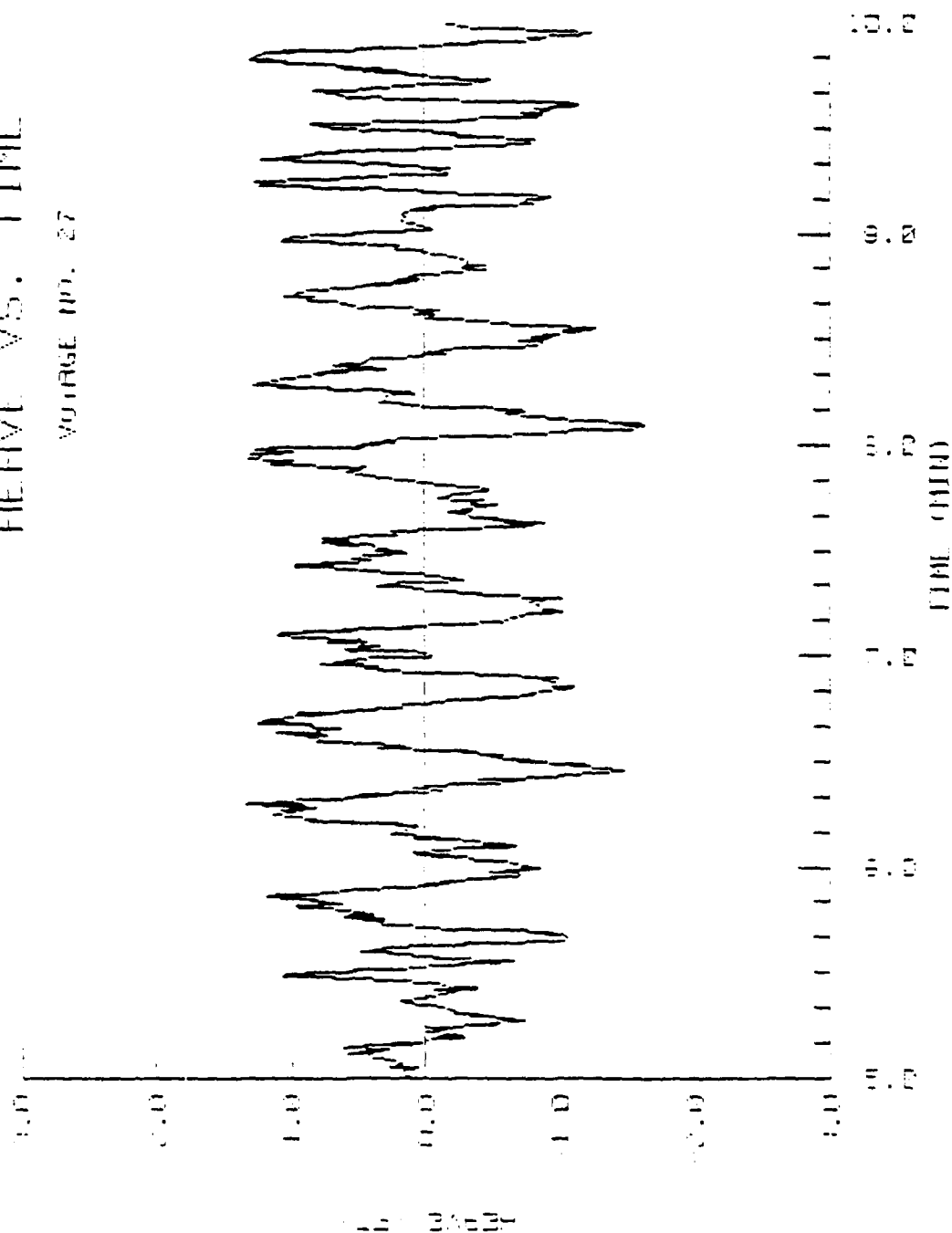


038 038 11 1007



# HEFIVE VS. TIME

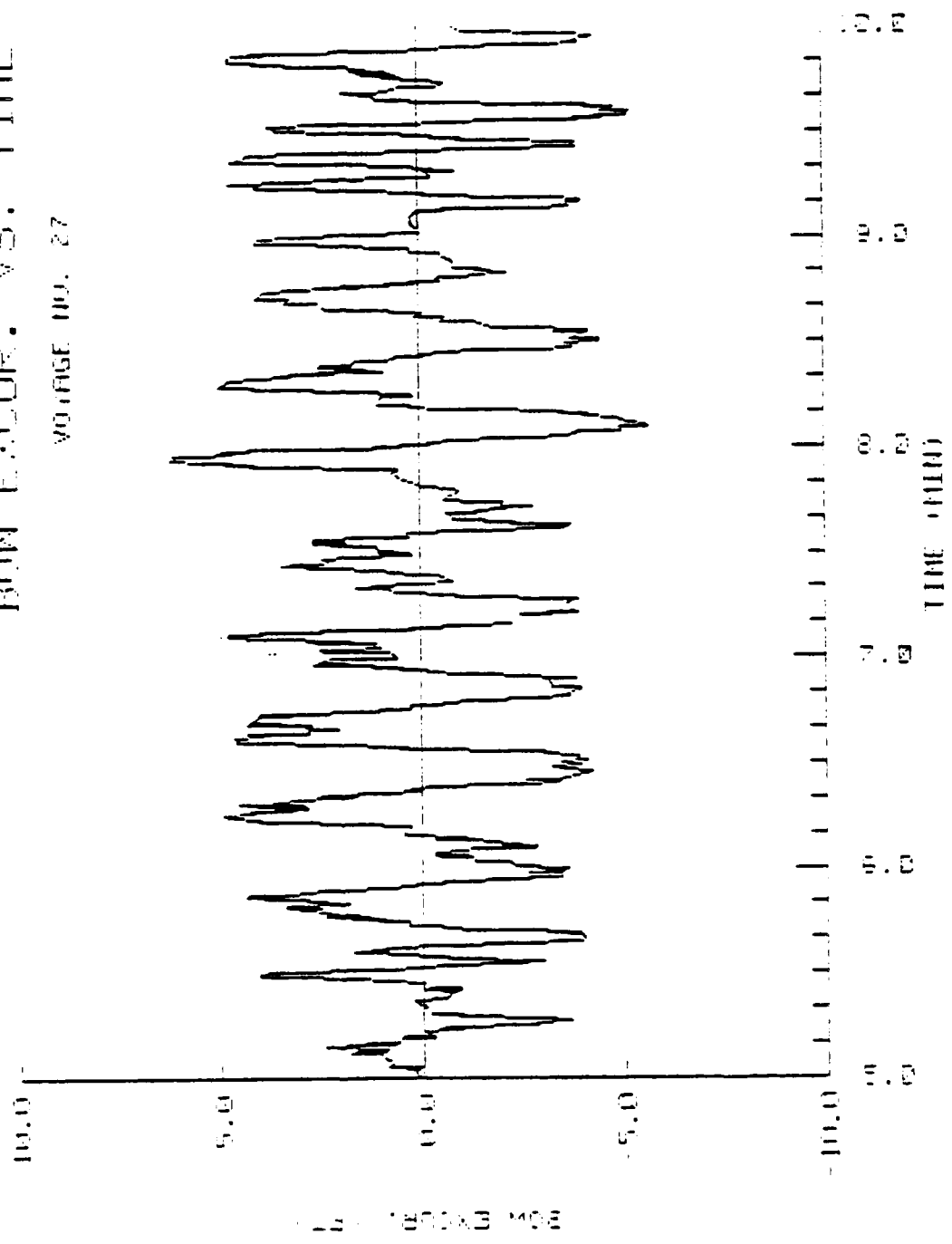
VOLUME NO. 27





BOM EXCUR. VS. TIME

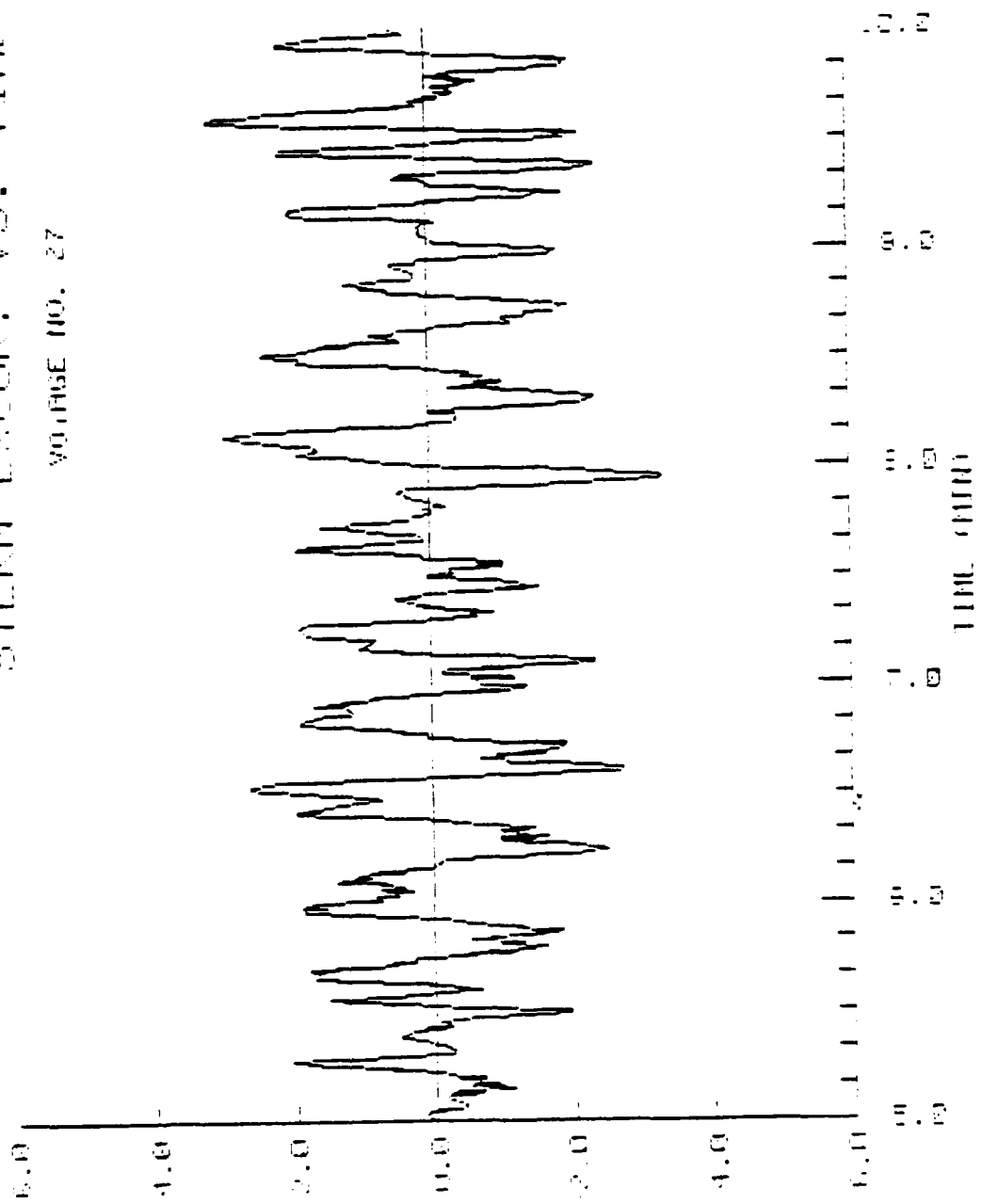
VOLUME NO. 27





# STERN EXCUR. VS. TIME

VOLUME NO. 27

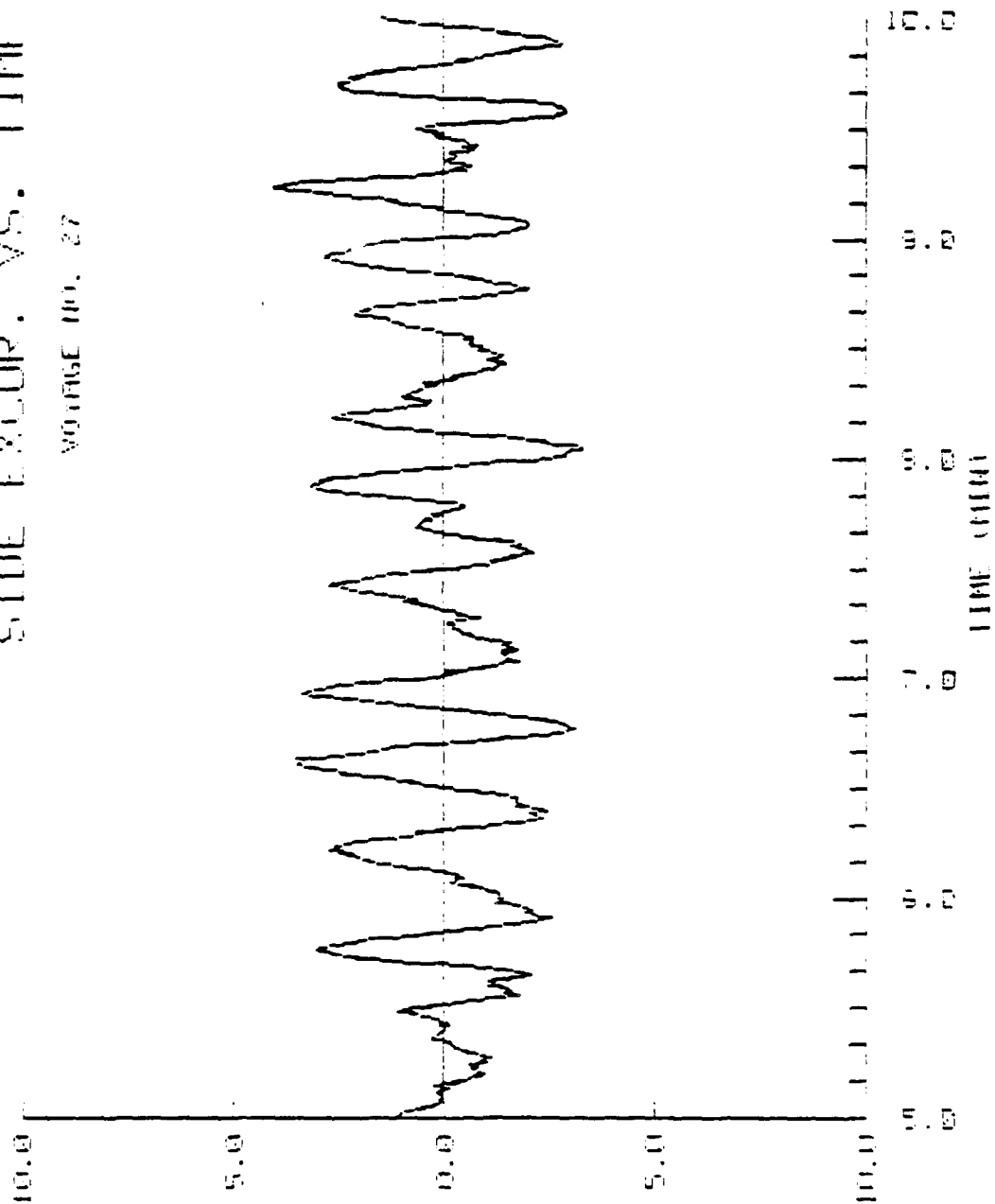


STERN EXCUR. VS. TIME



SIDE EXCUR. VS. TIME

VOLUME NO. 27





# STATISTICAL SUMMARY

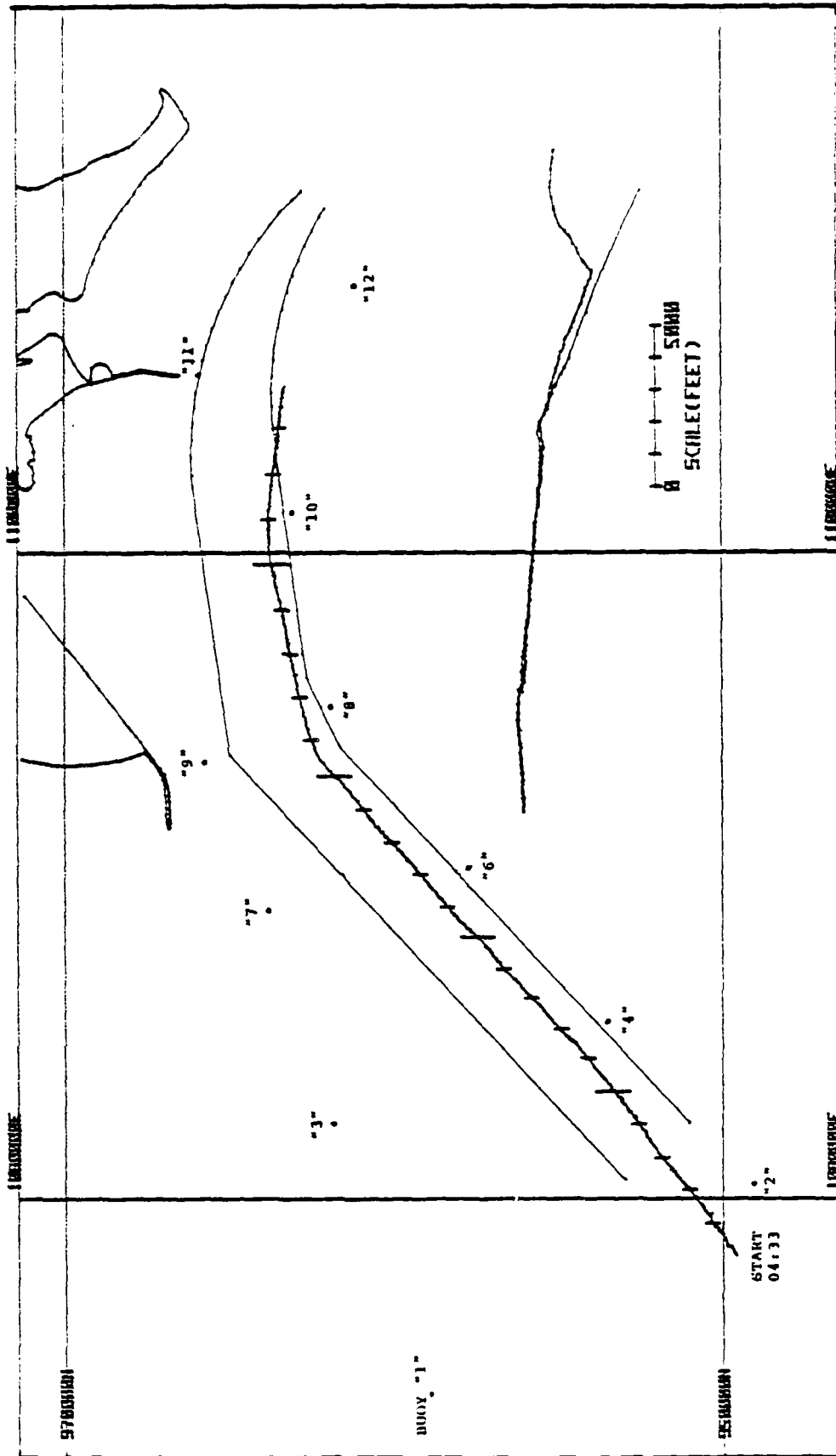
VOYAGE NO. 28

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH - DEG.	.3	1.6	.6	.7
ROLL - DEG.	.3	3.6	1.4	1.7
YAW - FT. SEC. SEC.	-0.0	1.9	.7	.8
HEAVE - FT.	-0.0	6.1	1.8	2.2
ROLL EXCUR. - FT.	-0.0	14.6	4.3	5.2
STUPE EXCUR. - FT.	.0	5.6	1.9	2.1
SIDE EXCUR. - FT.	-0.0	7.1	2.3	2.7



# VOYAGE NO. 28 SHIP TRACK

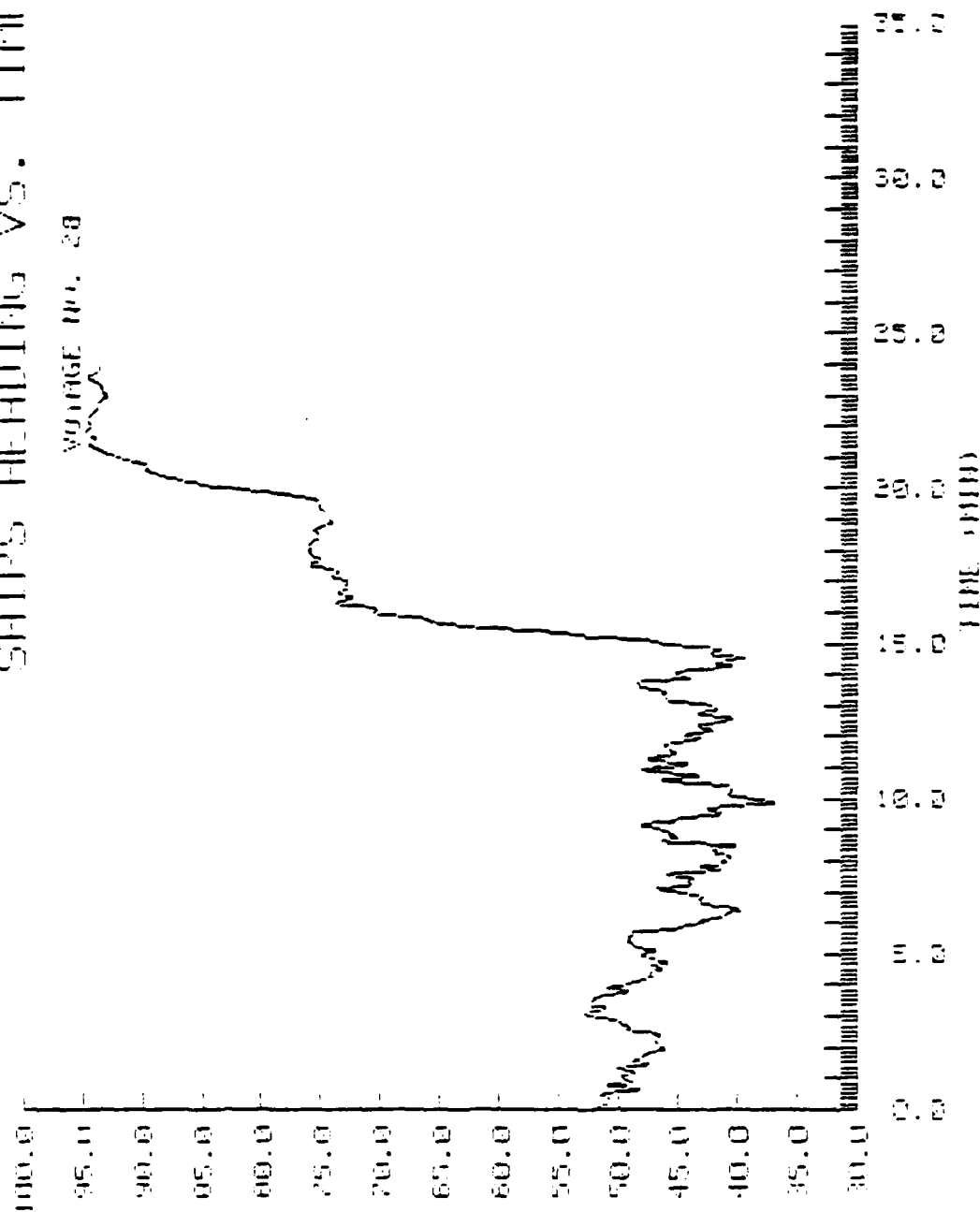
SCALE 1:3000





# SHIPS HEADING VS. TIME

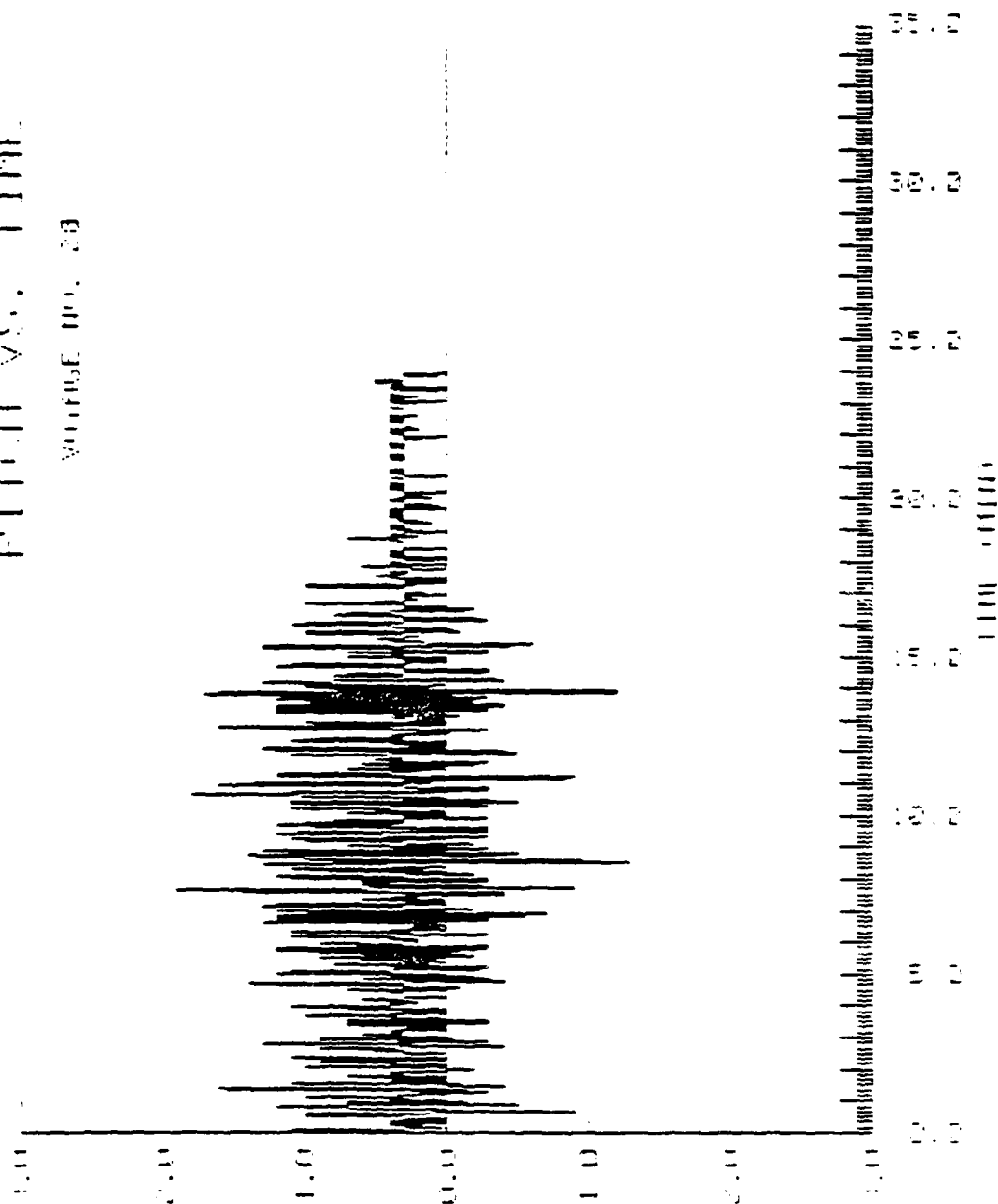
VOLUME 100, 20





# PLATE VS. TIME

VOLUME 100, 28

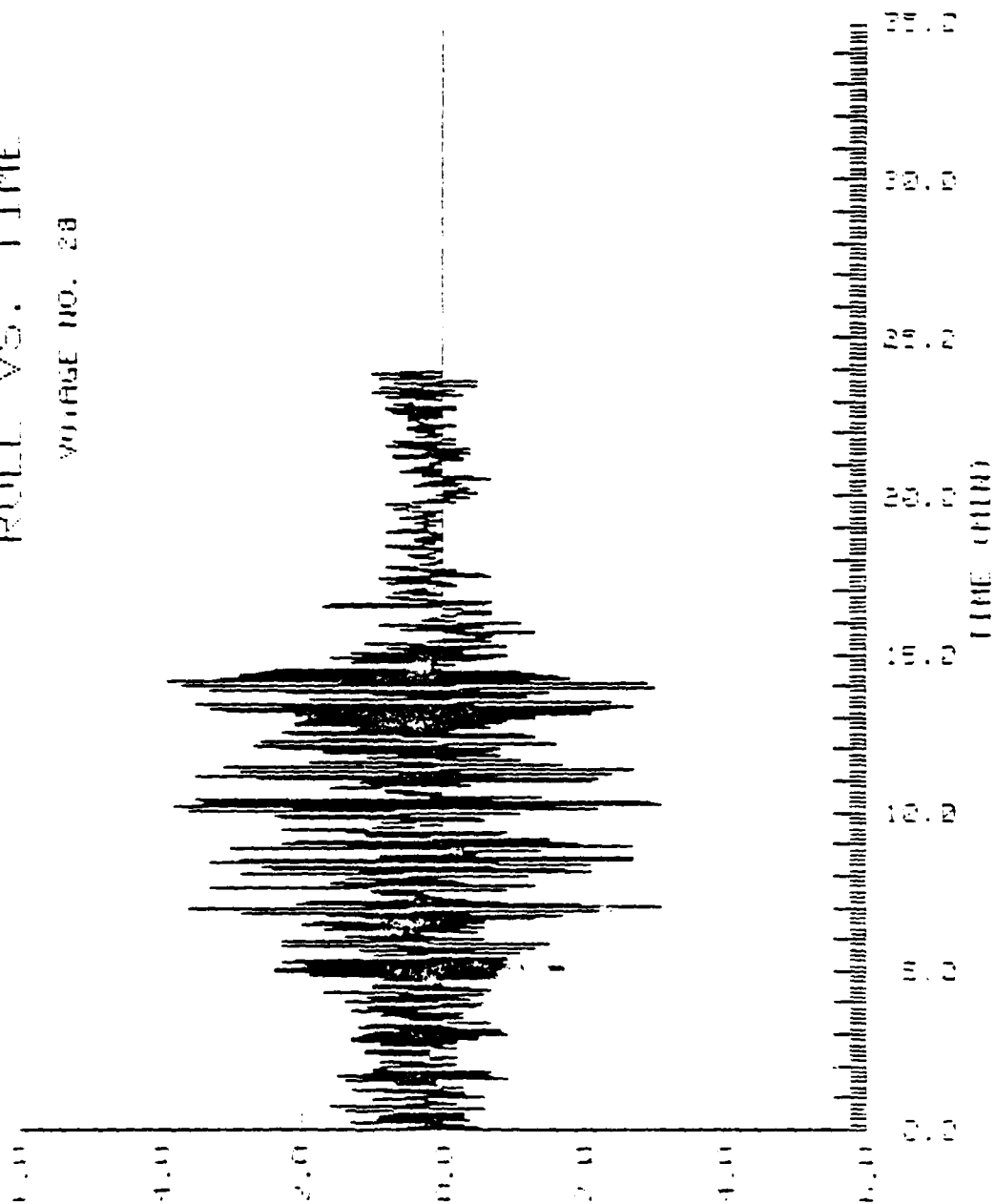


100 - 100



# ROLL VS. TIME

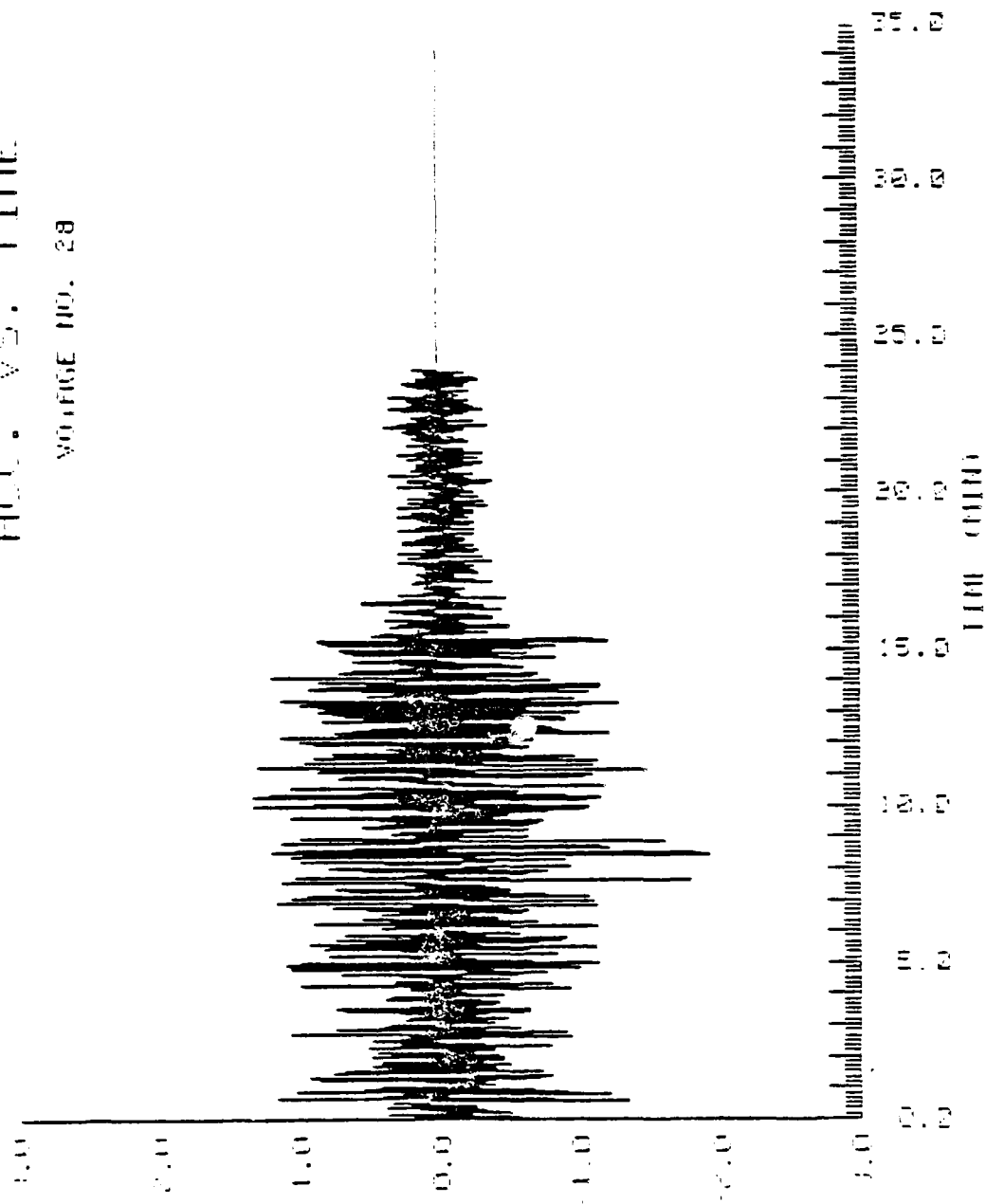
VOLTAJE NO. 28





REC. VS. TIME

VOLUME NO. 28

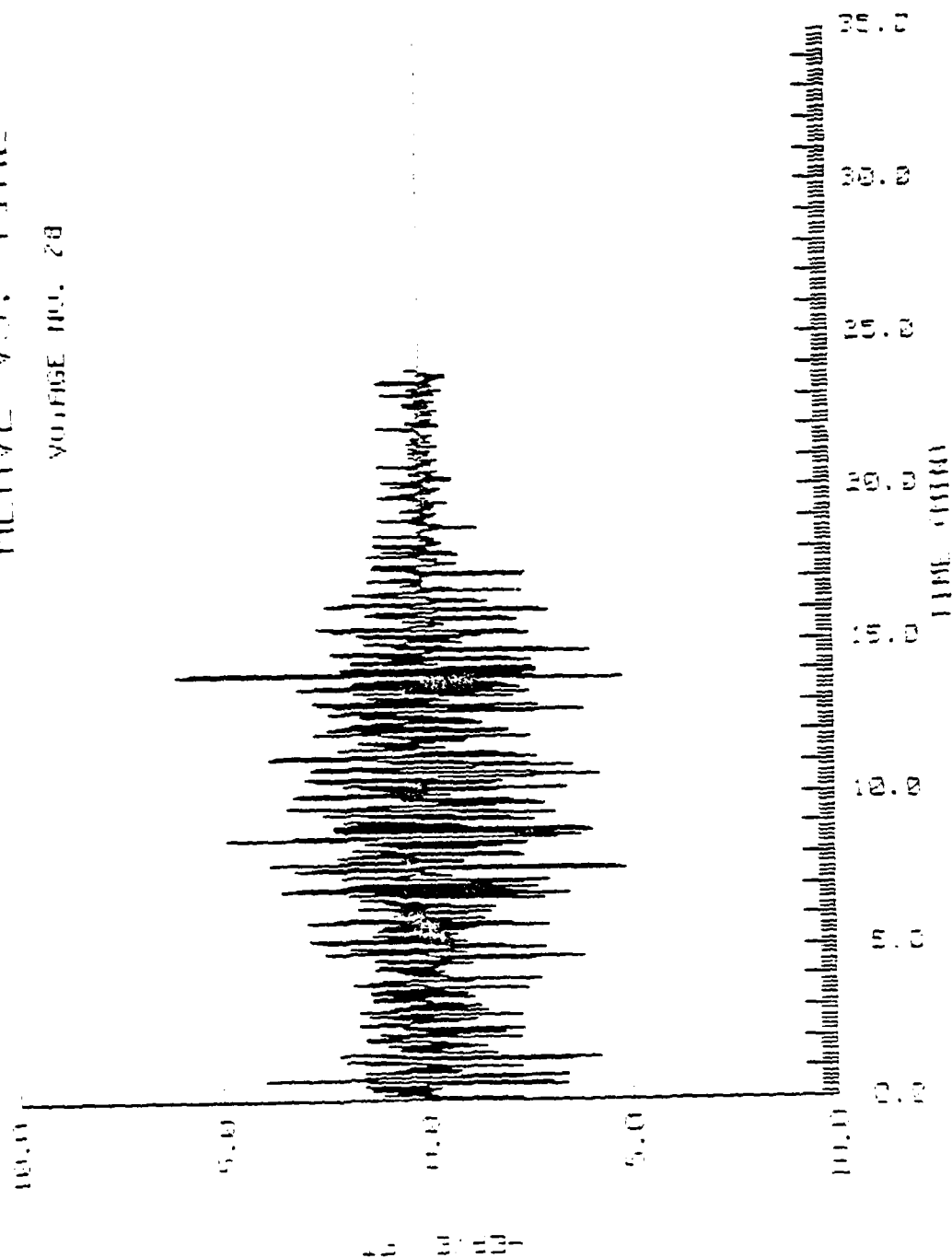


133 133 133 133



# RELATIVE VS. TIME

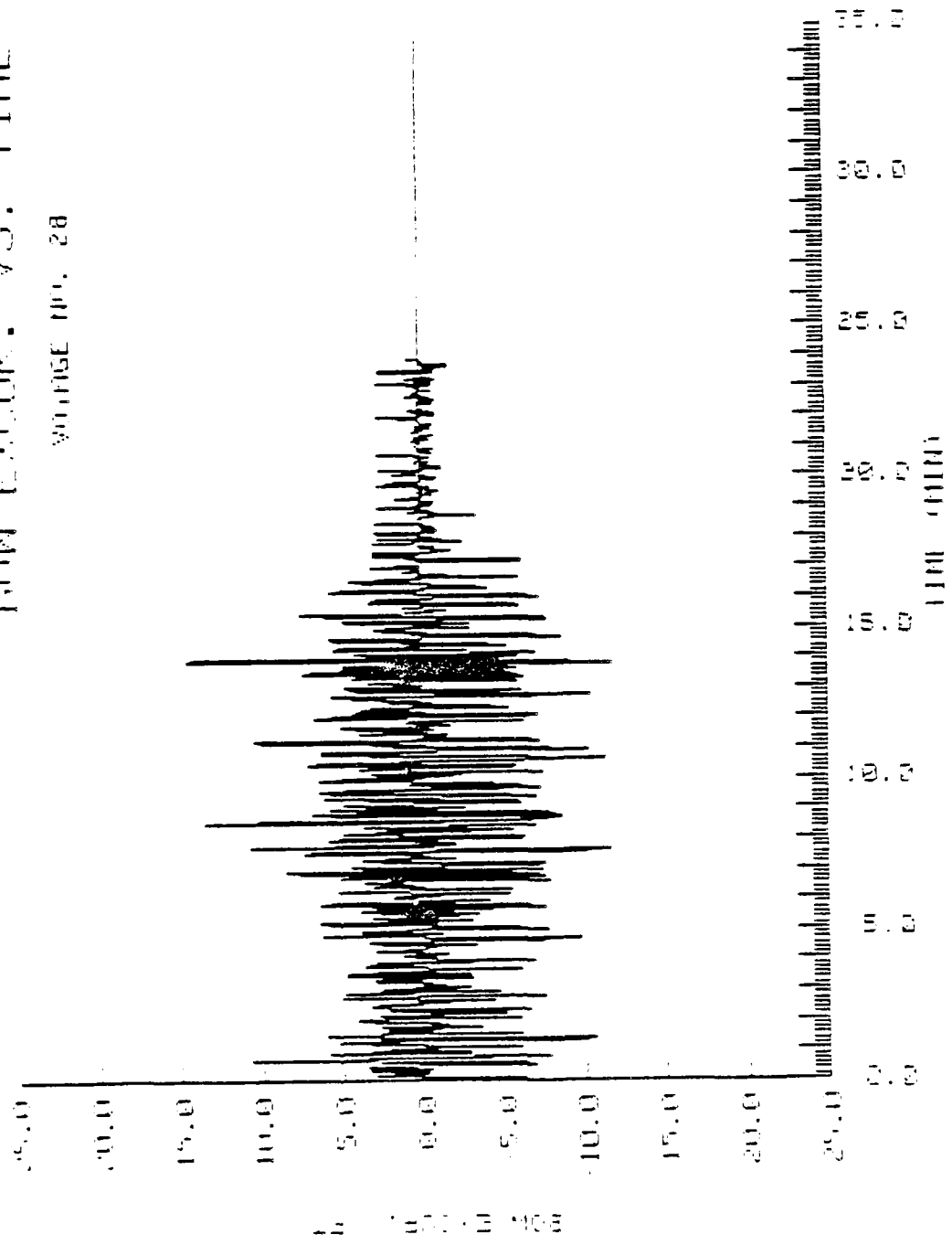
VOLUME NO. 28





# POWER SPECTRUM VS. TIME

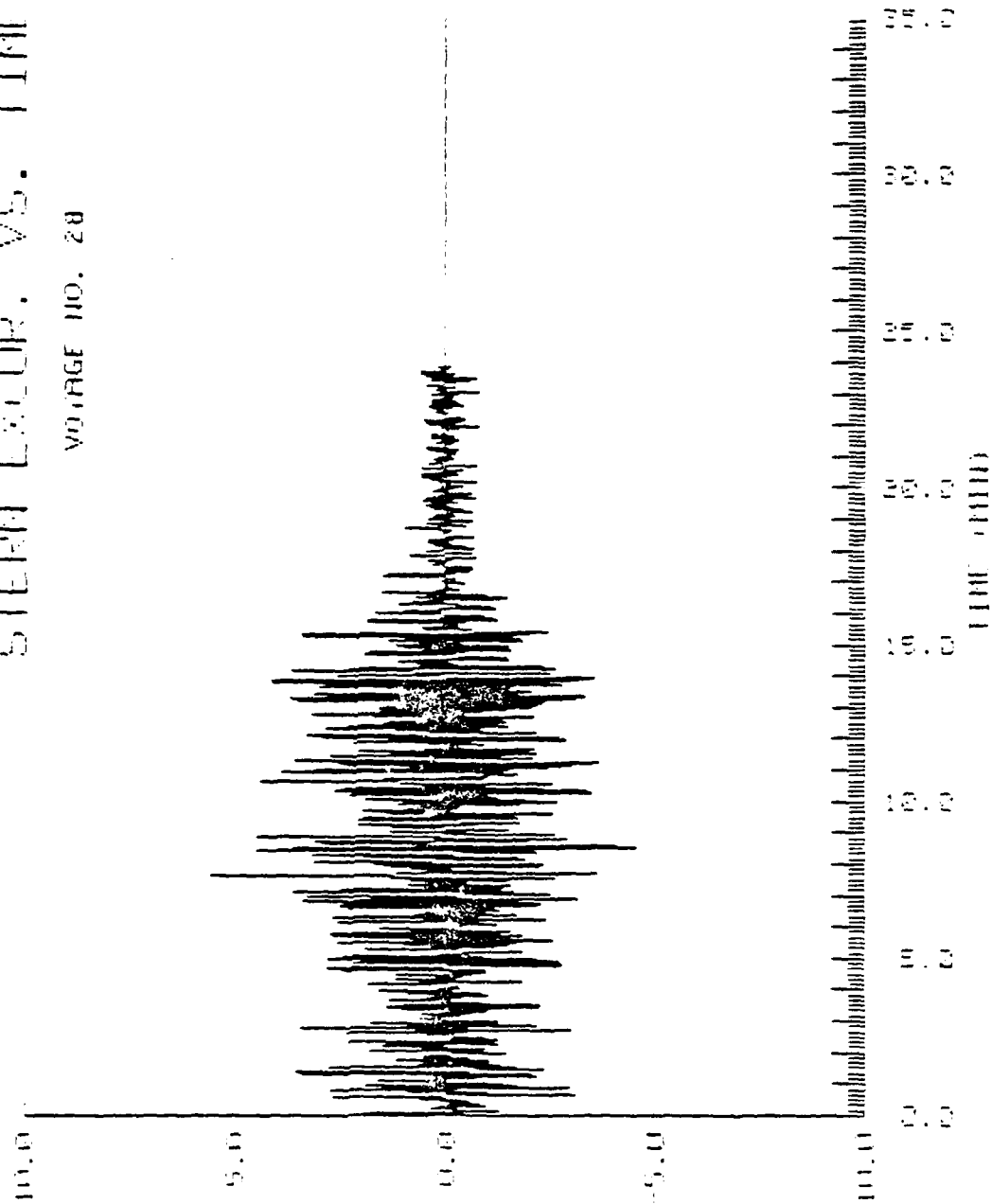
VOLUME NO. 28





# STERN EXCUR. VS. TIME

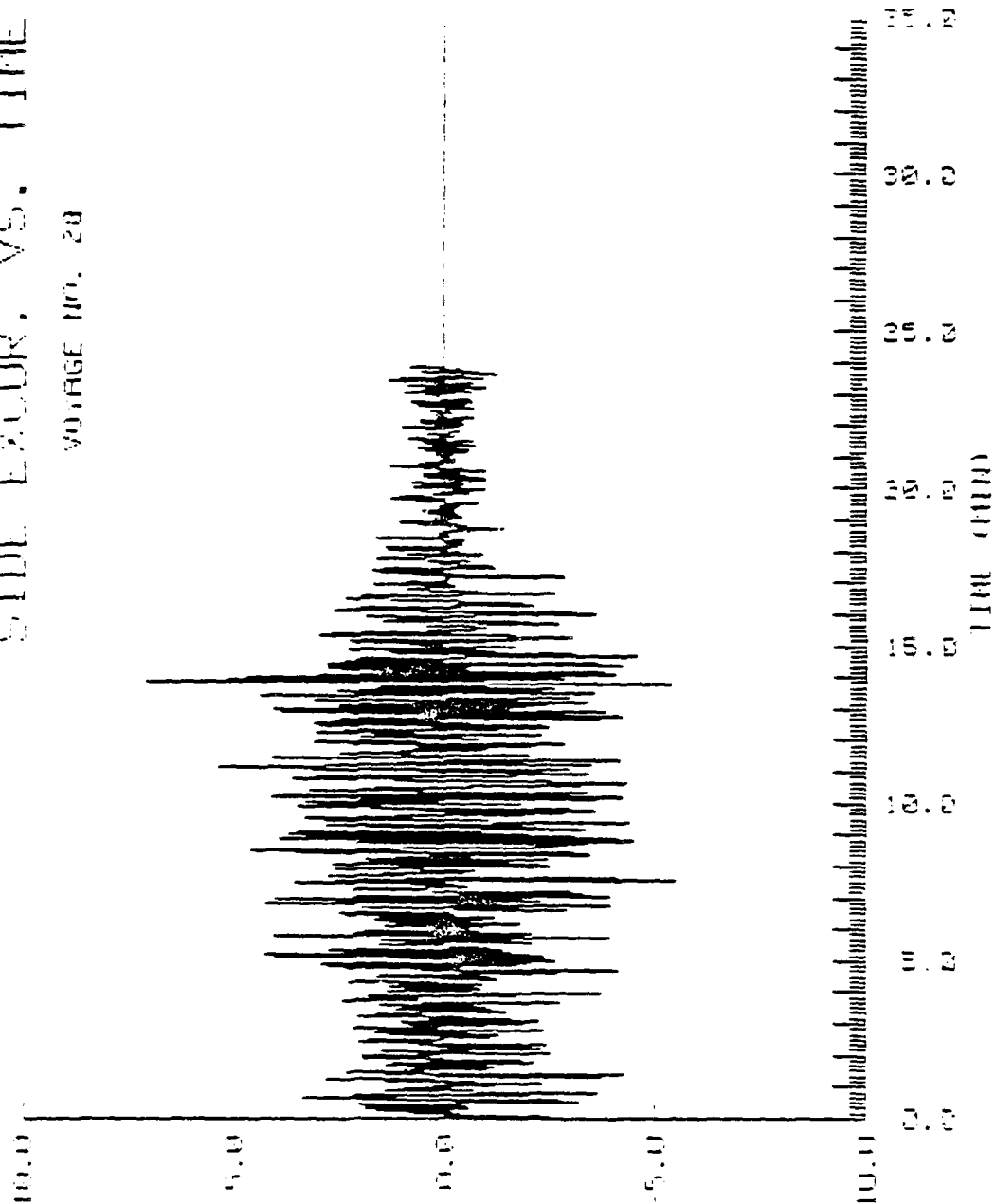
VOLTAGE 110. 28





# SIDE EXCUR. VS. TIME

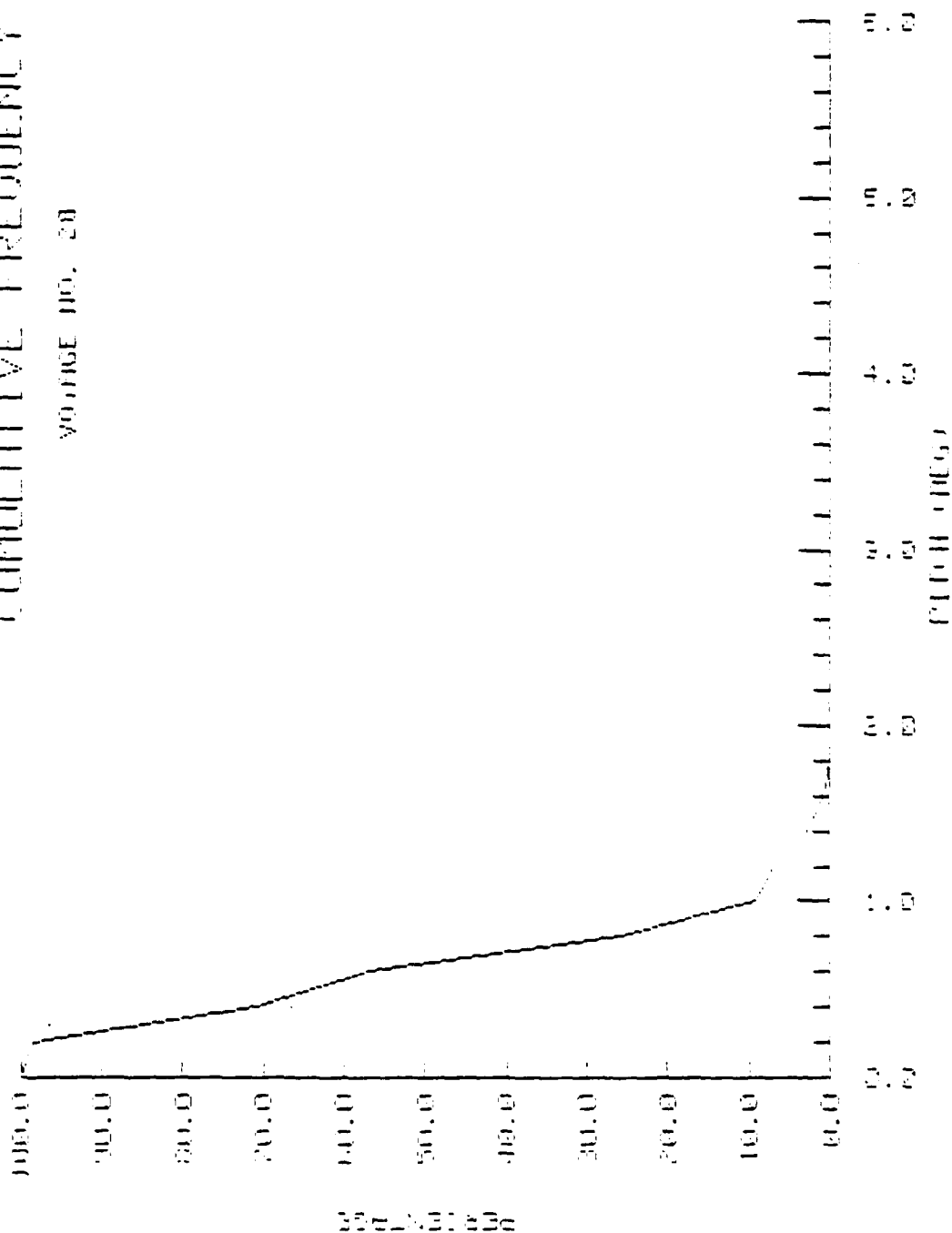
VOLUME NO. 20





# CUMULATIVE FREQUENCY

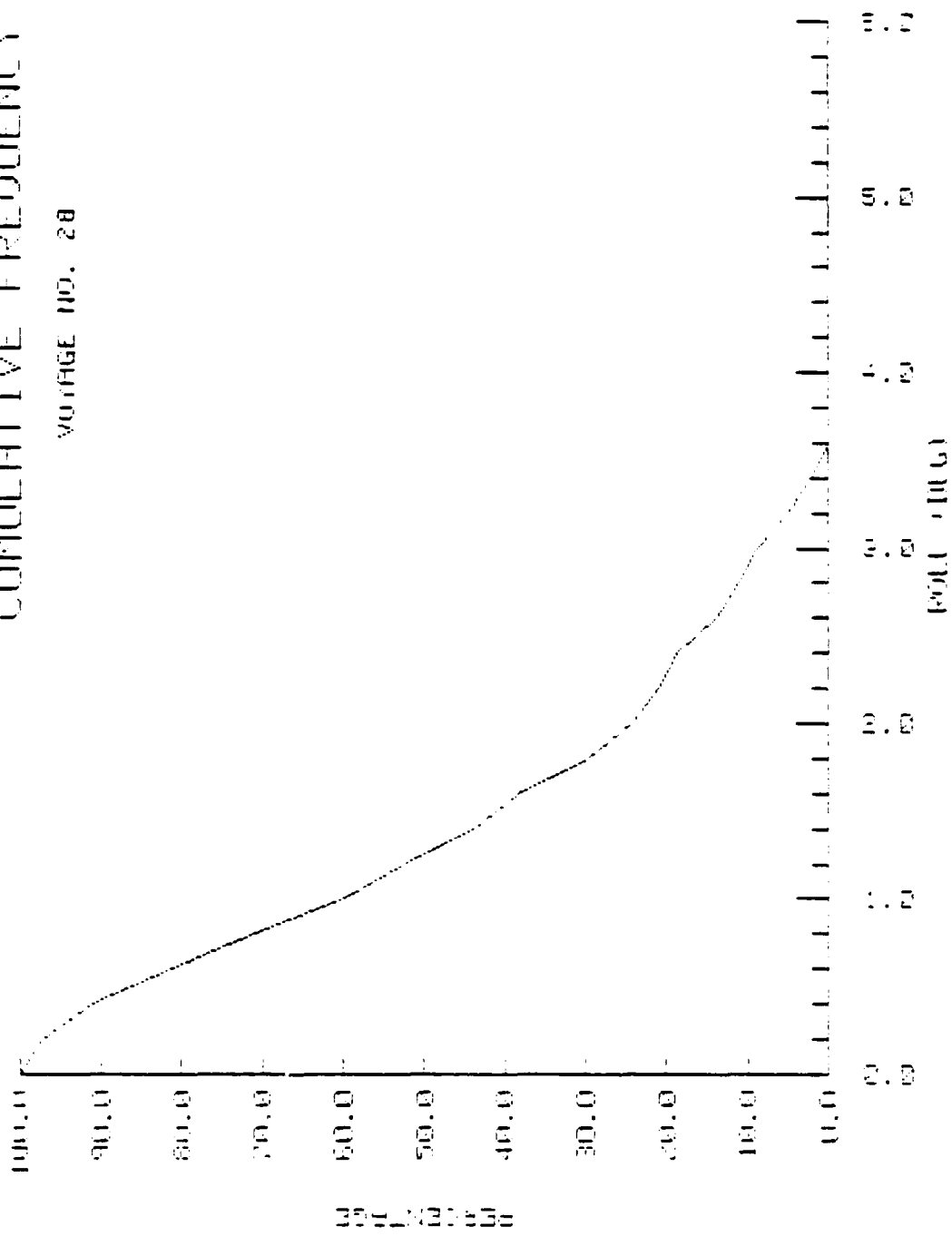
VOLUME NO. 20





# CUMULATIVE FREQUENCY

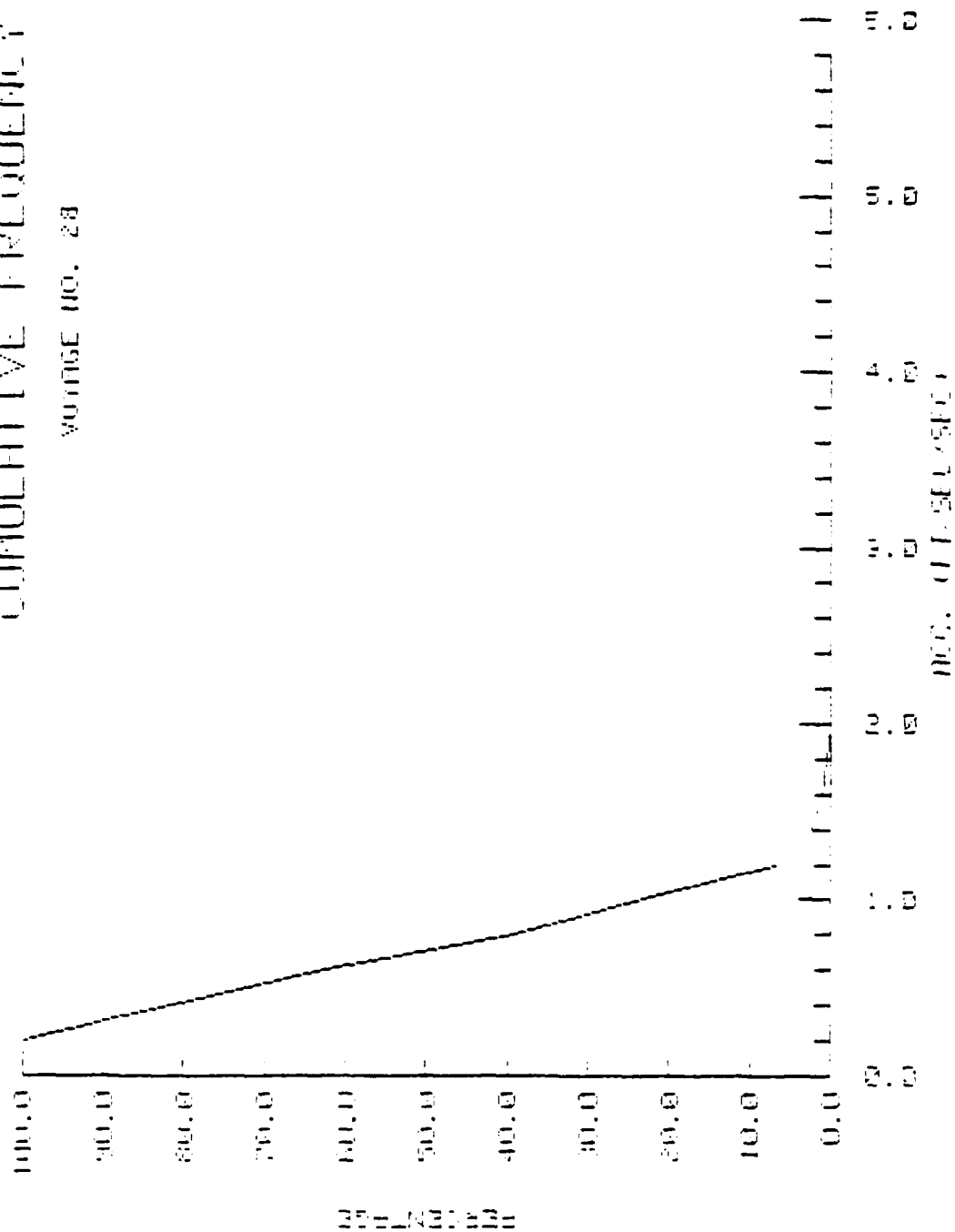
VOLUME NO. 28





# CUMULATIVE FREQUENCY

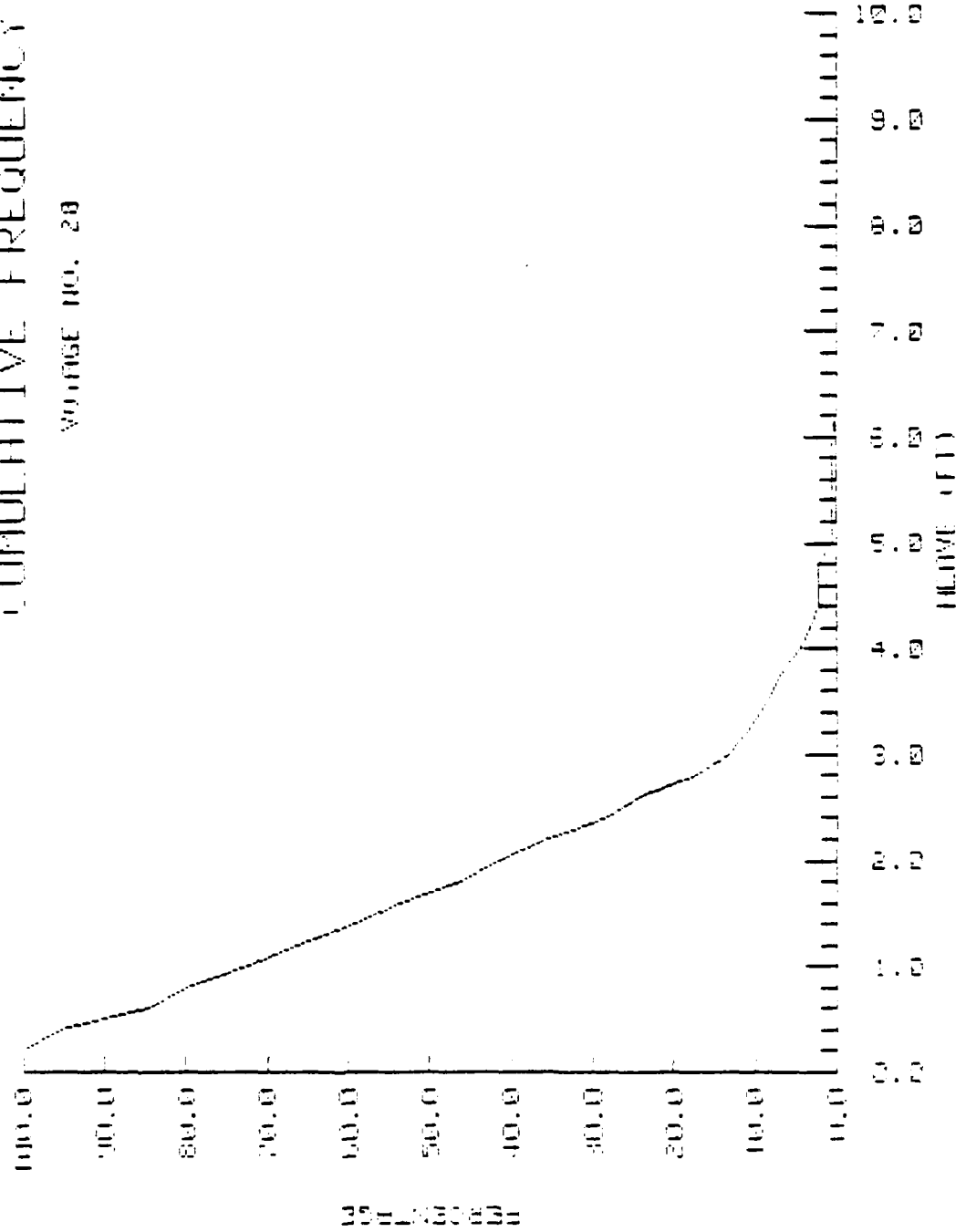
VOLUME NO. 28





# CUMULATIVE FREQUENCY

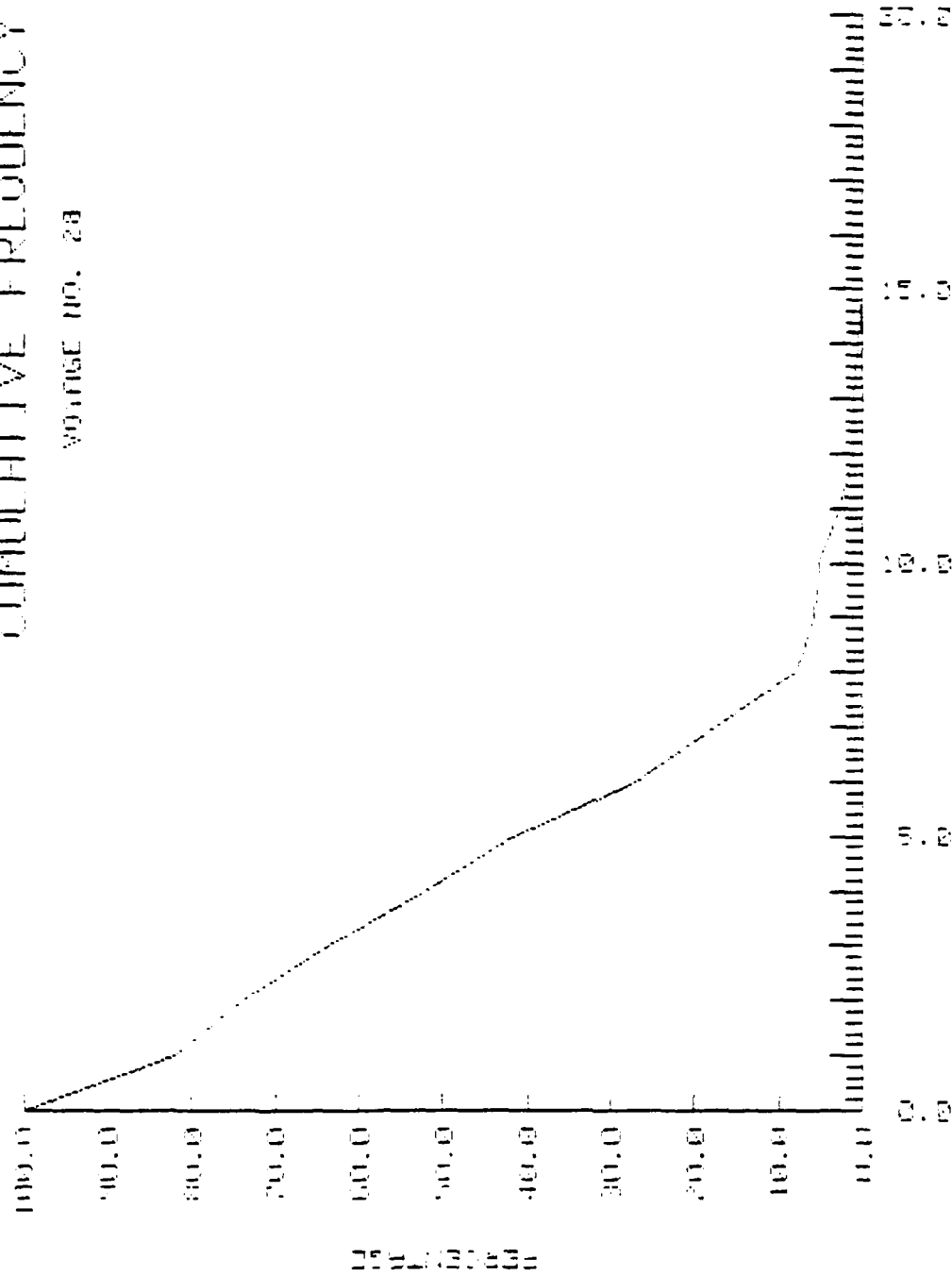
VOLUME NO. 28





# CUMULATIVE FREQUENCY

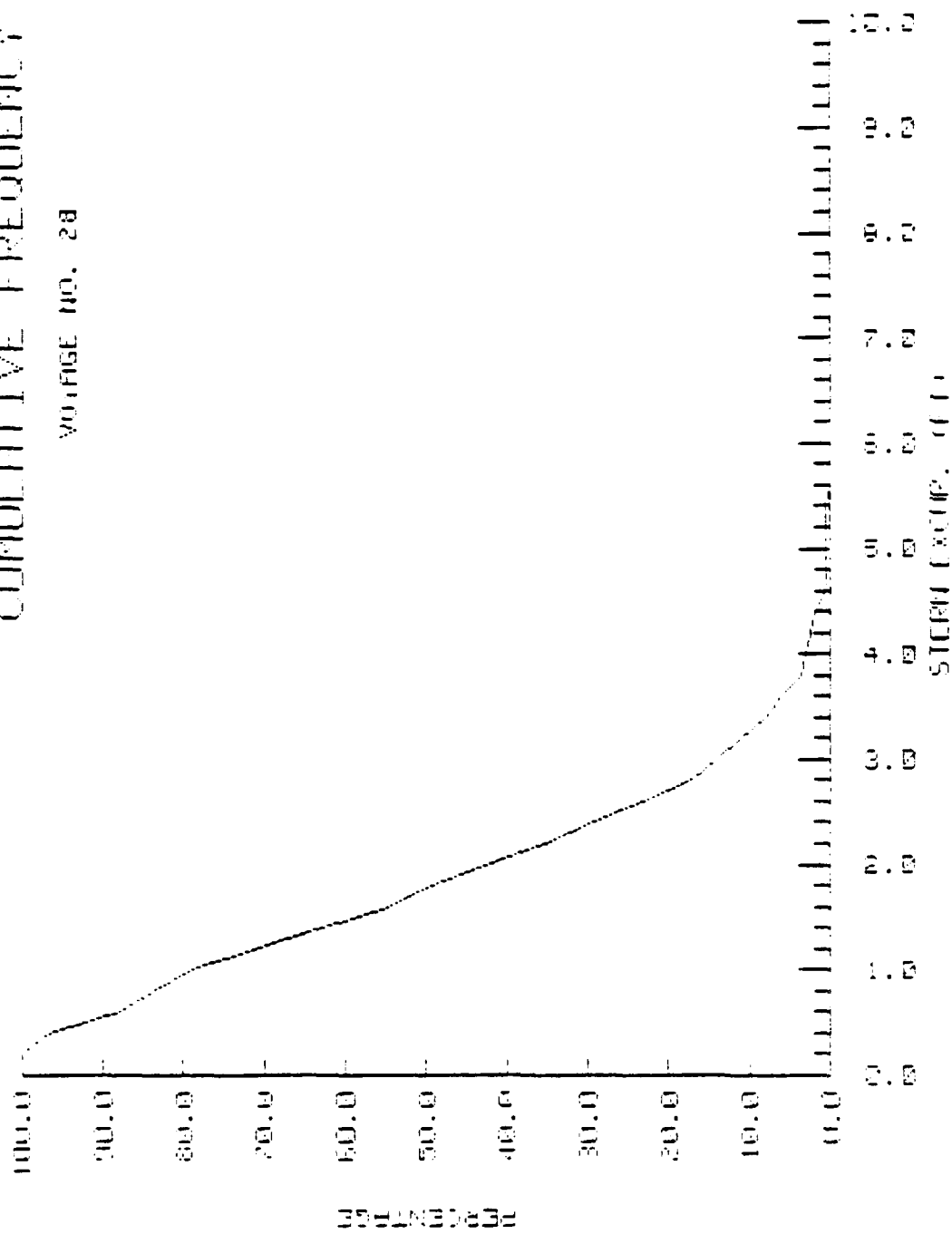
VOICE NO. 28





# CUMULATIVE FREQUENCY

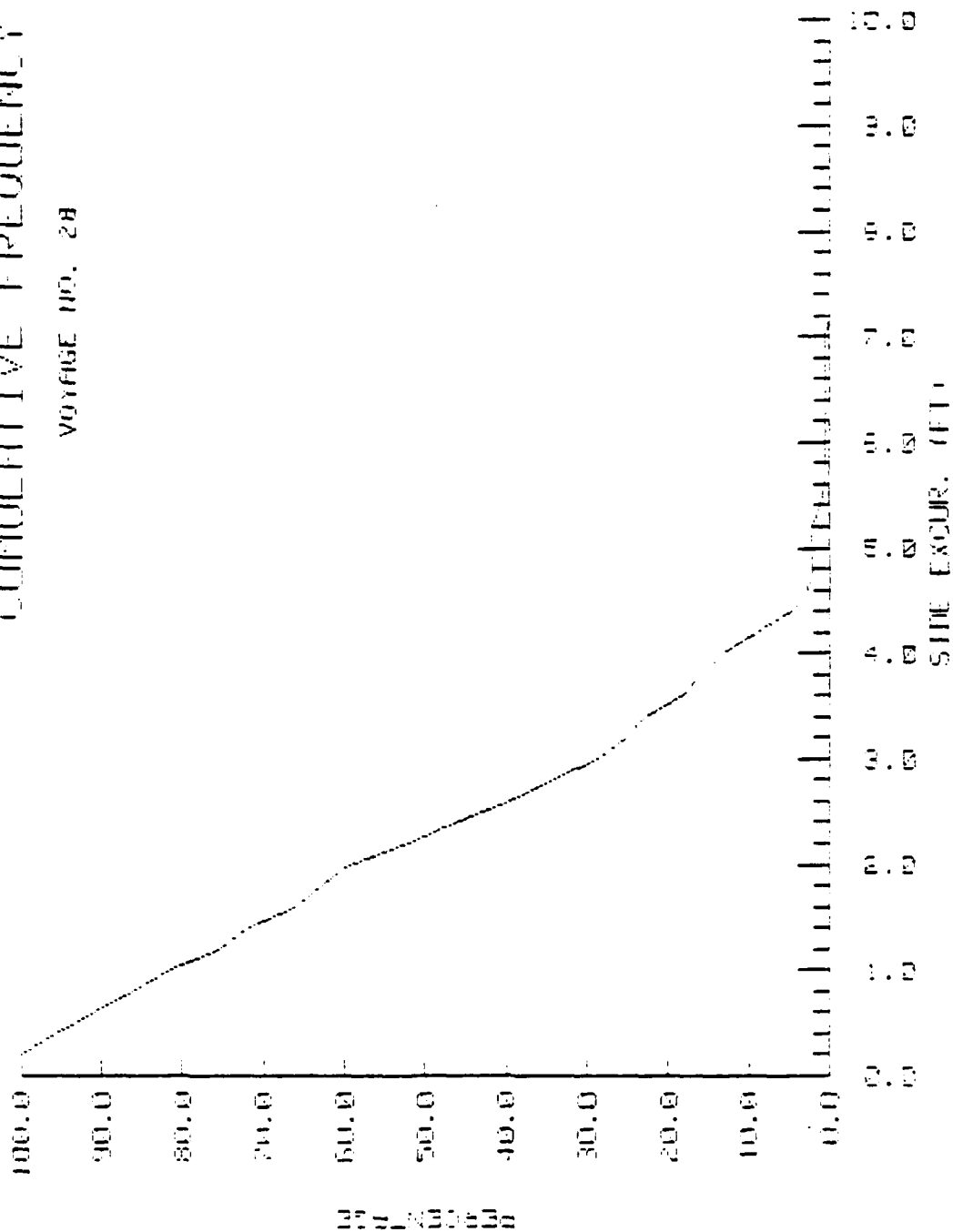
VOLUME NO. 28





# CUMULATIVE FREQUENCY

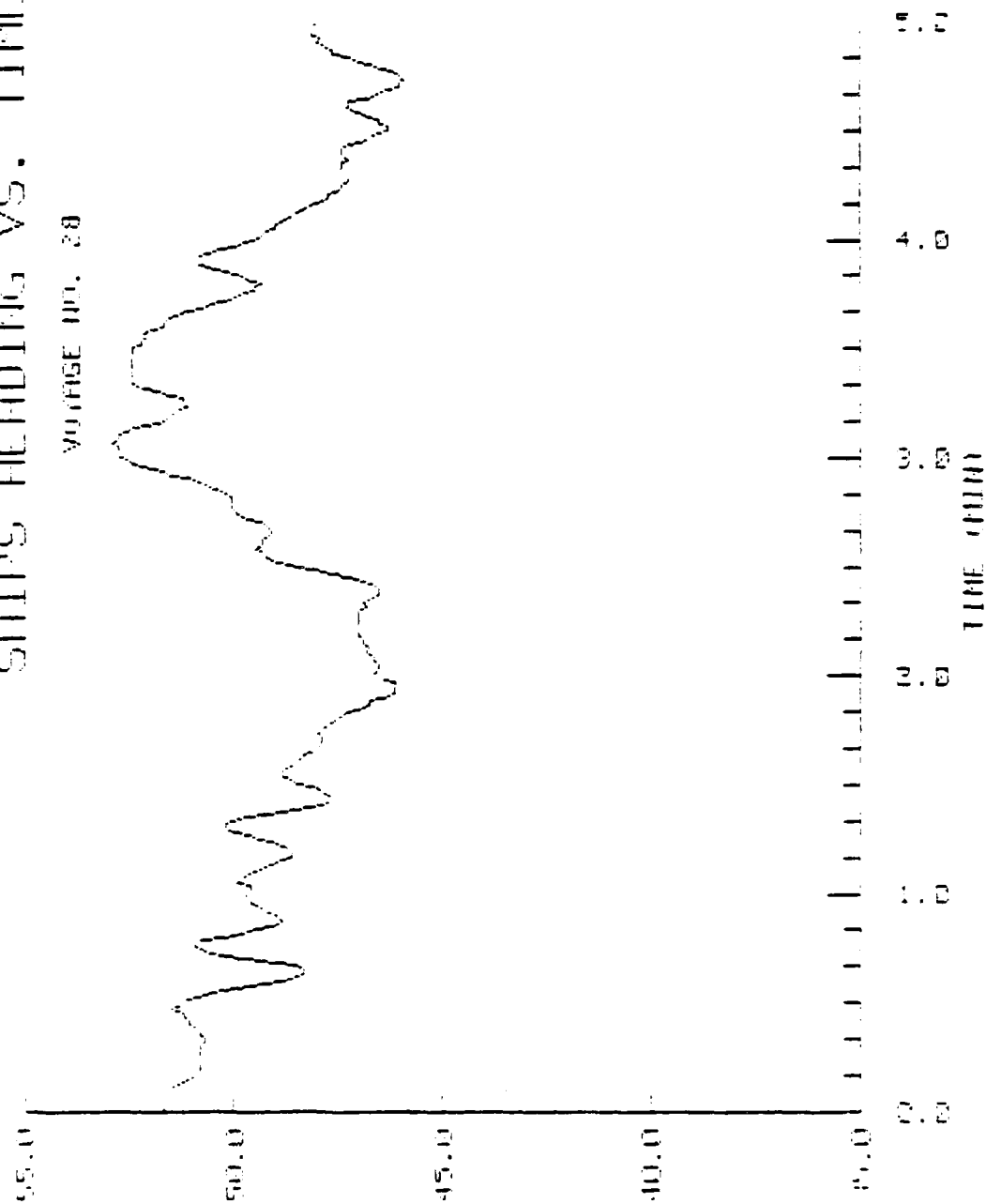
VOYAGE NO. 28





# SHIPS HEADING VS. TIME

## VORAGE NO. 28

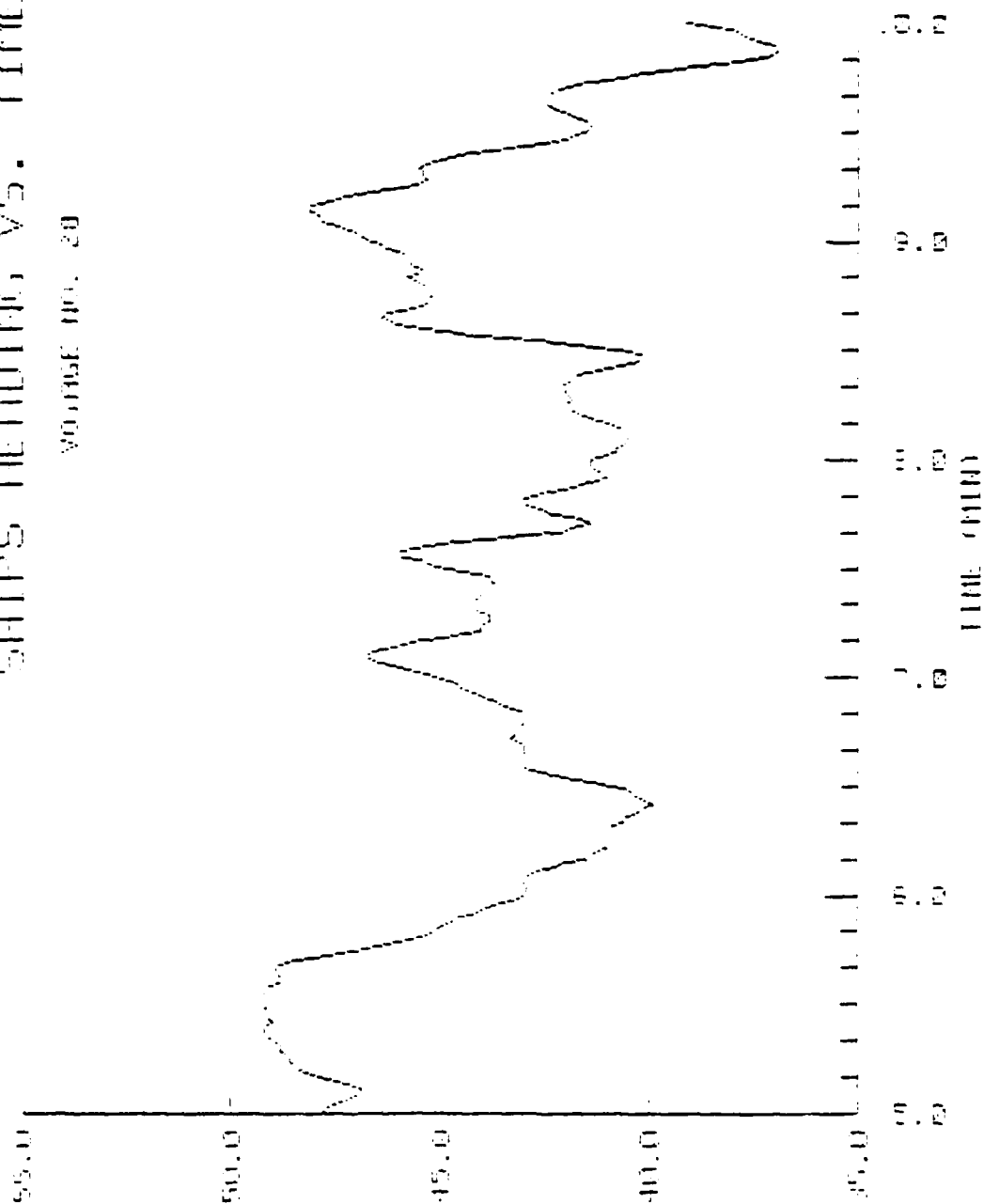


50.0 45.0 40.0 35.0



# SHIPS HEADING VS. TIME

VOLUME 100, 20

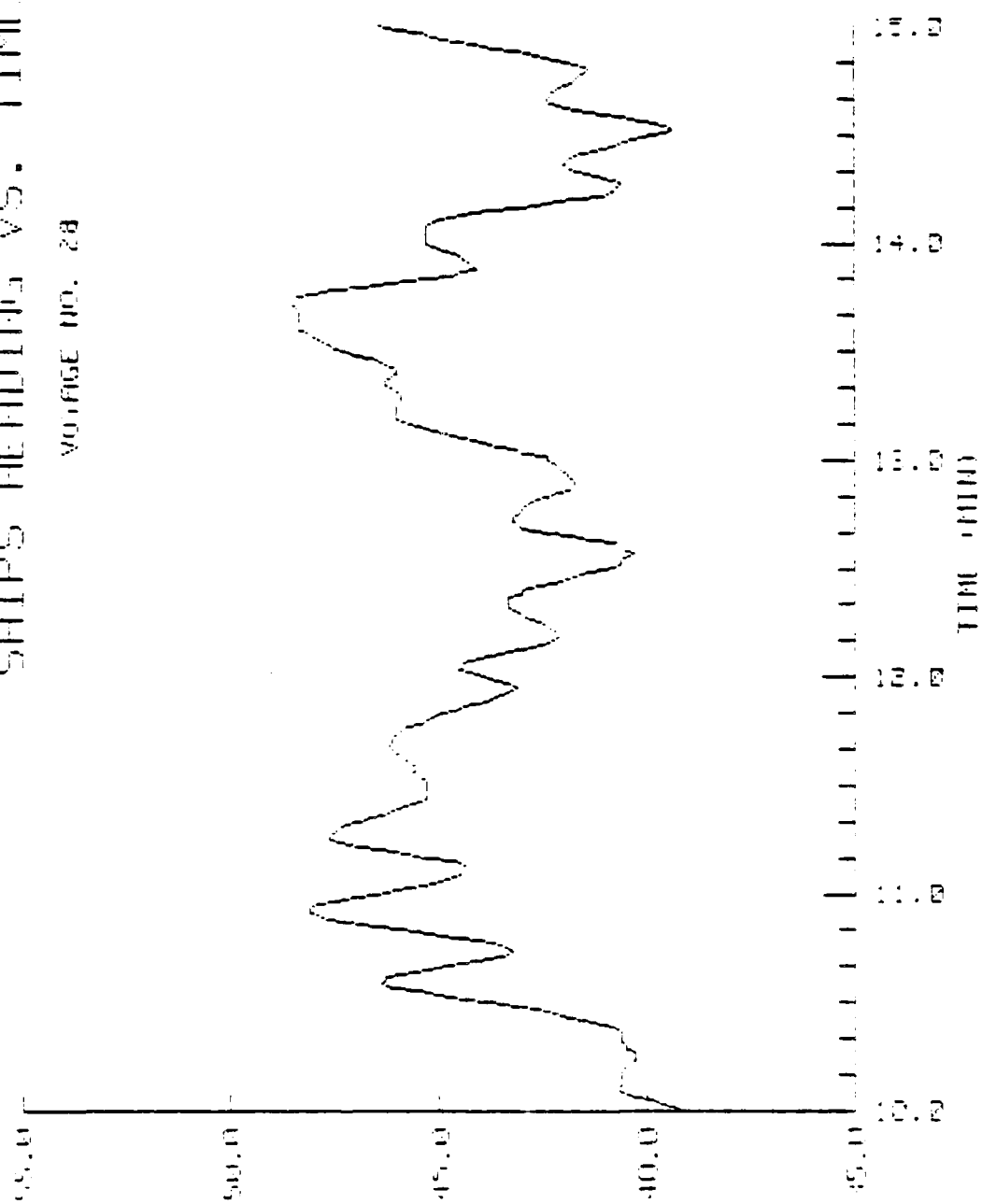


100 - 10010-01- 0011-0



# SHIPS HEADING VS. TIME

VOLUME NO. 28

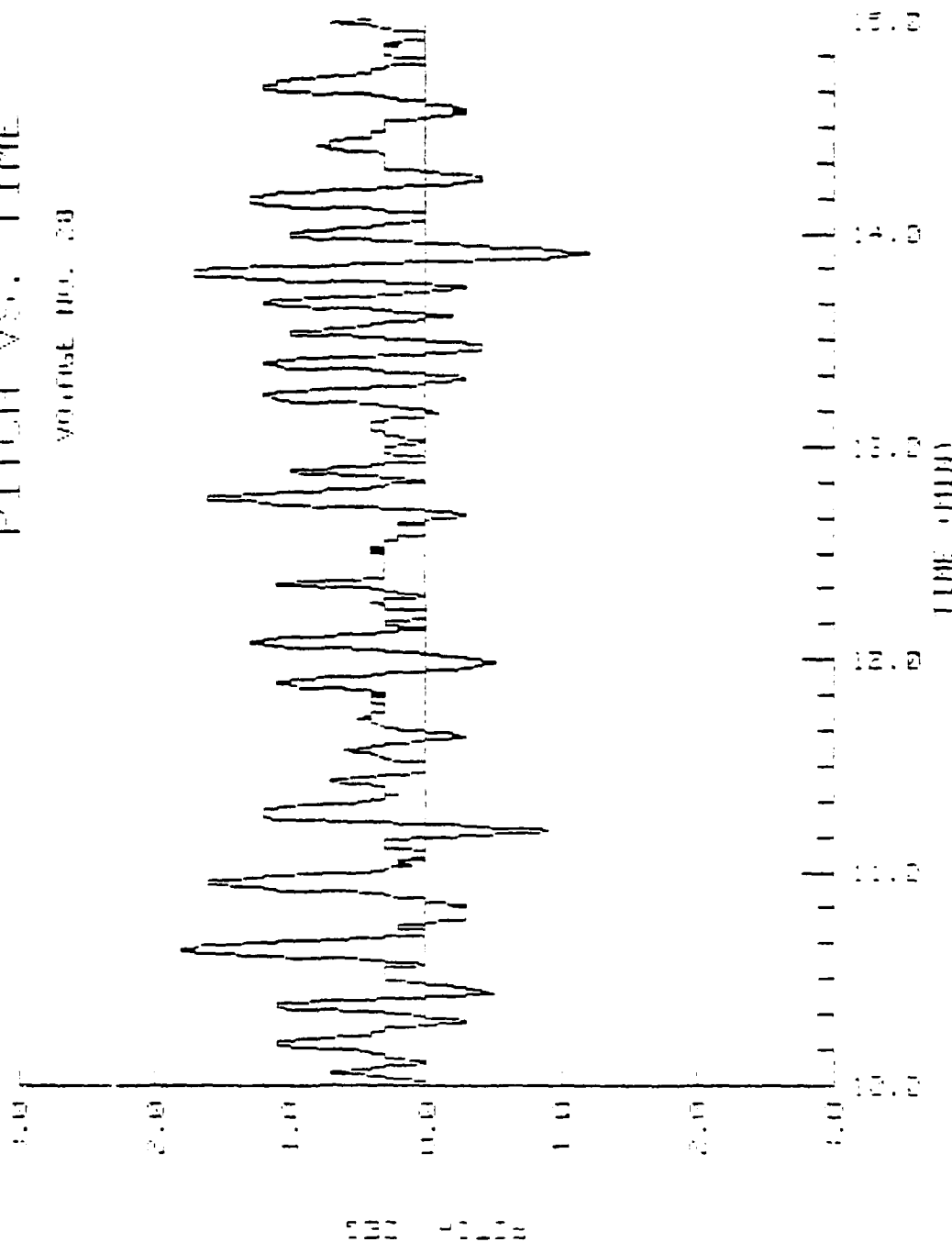


1000 2000 3000 4000 5000 6000 7000 8000 9000



# PITCH VS. TIME

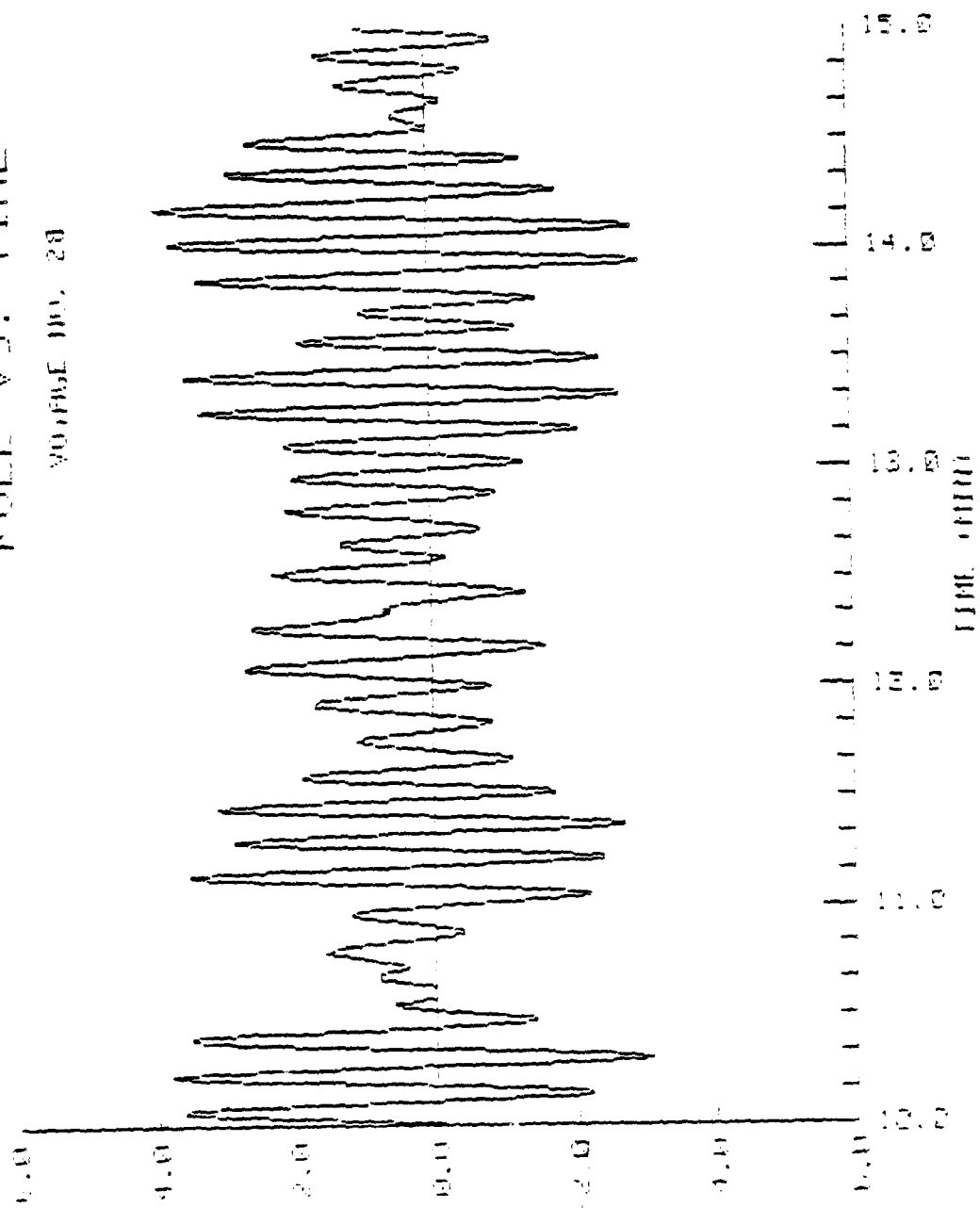
VOICE NO. 28





# POLL VS. TIME

VOLUME NO. 28

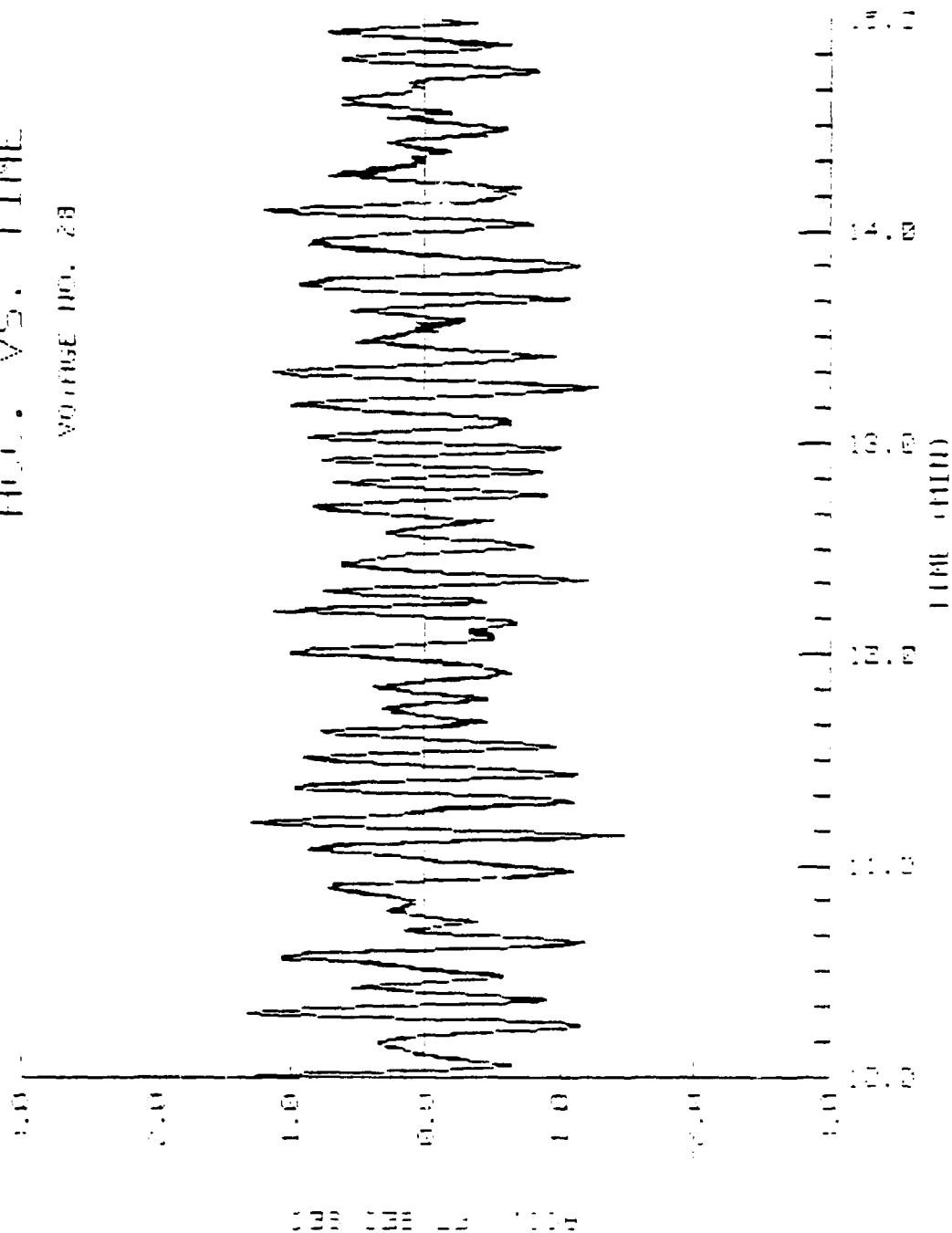


1000 - 1000



FOC. VS. TIME

VOLUME NO. 28





AD-A098 984

TETRA TECH INC PASADENA CA

F/G 13/10

COLUMBIA RIVER ENTRANCE CHANNEL DEEP-DRAFT VESSEL MOTION STUDY.--ETC(U)

SEP 80 S WANG, M KIMBLE, C BUTCHER, G D COX

DACW57-78-C-0028

UNCLASSIFIED

TETRAT-TC-3925-APP-A(1)

NL

8 of 8

AD-A098 984

■

END

DATE

ENRWD

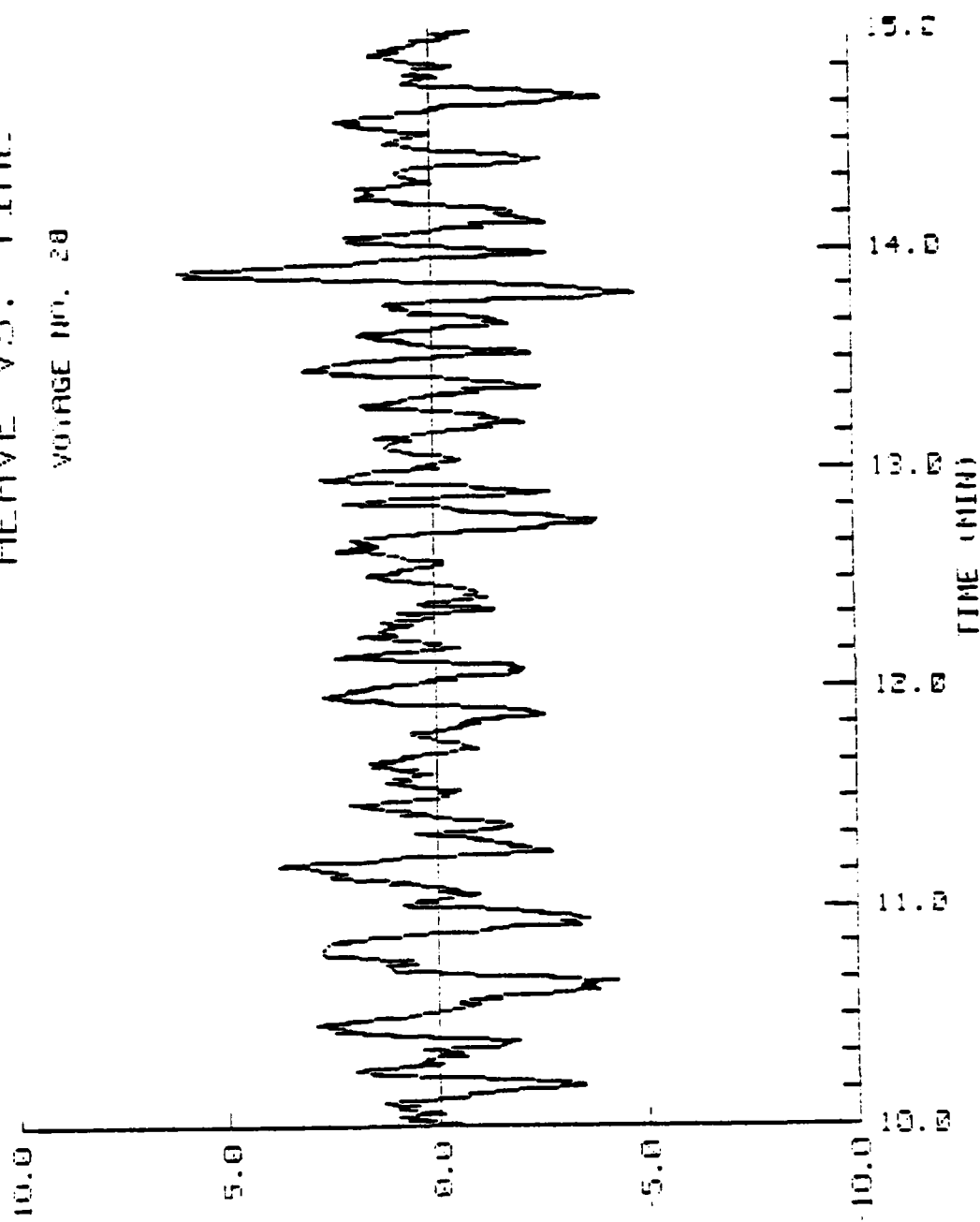
6-81

DTIC



# HEAVE VS. TIME

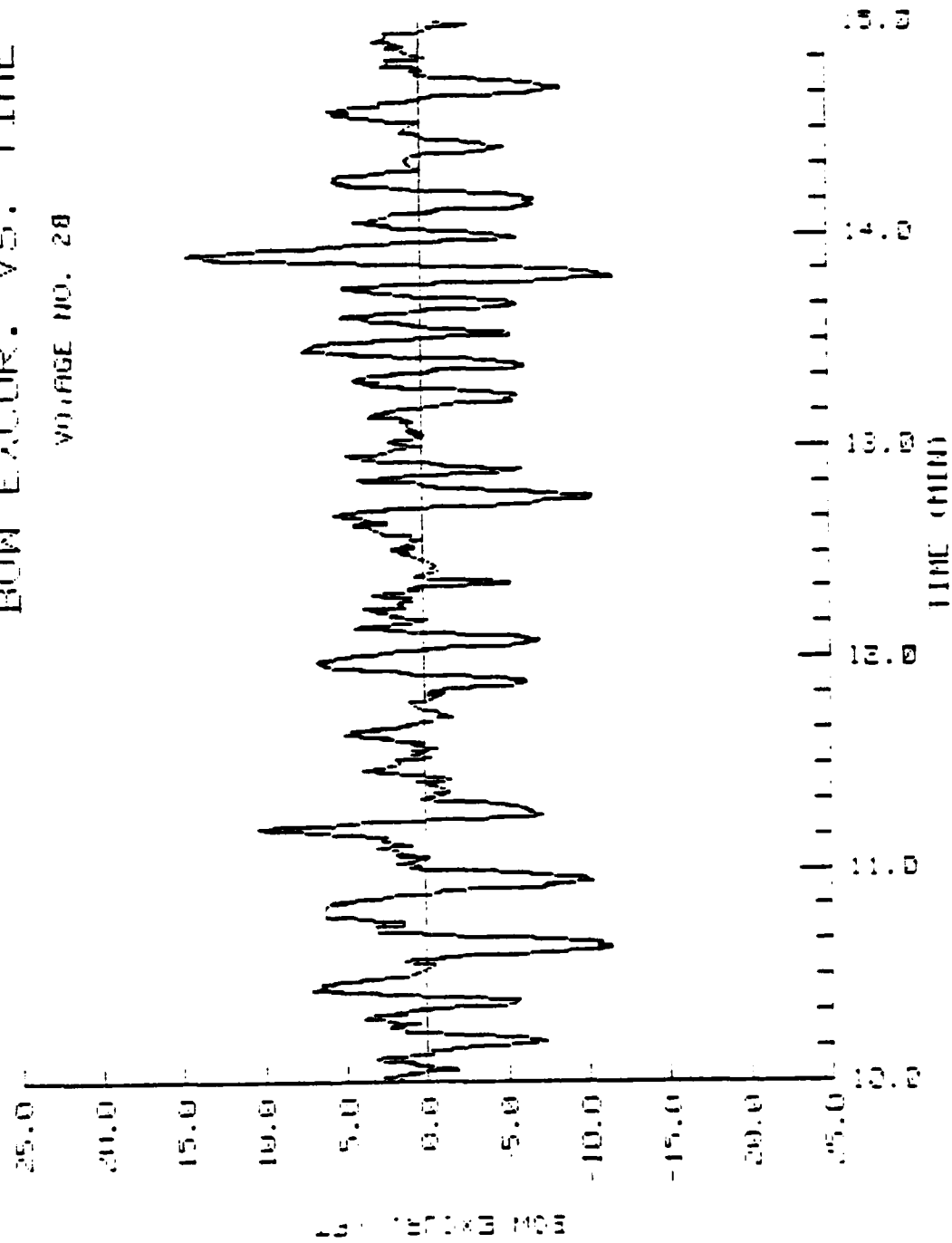
VOLUME NO. 20





# ROM EXCUR. VS. TIME

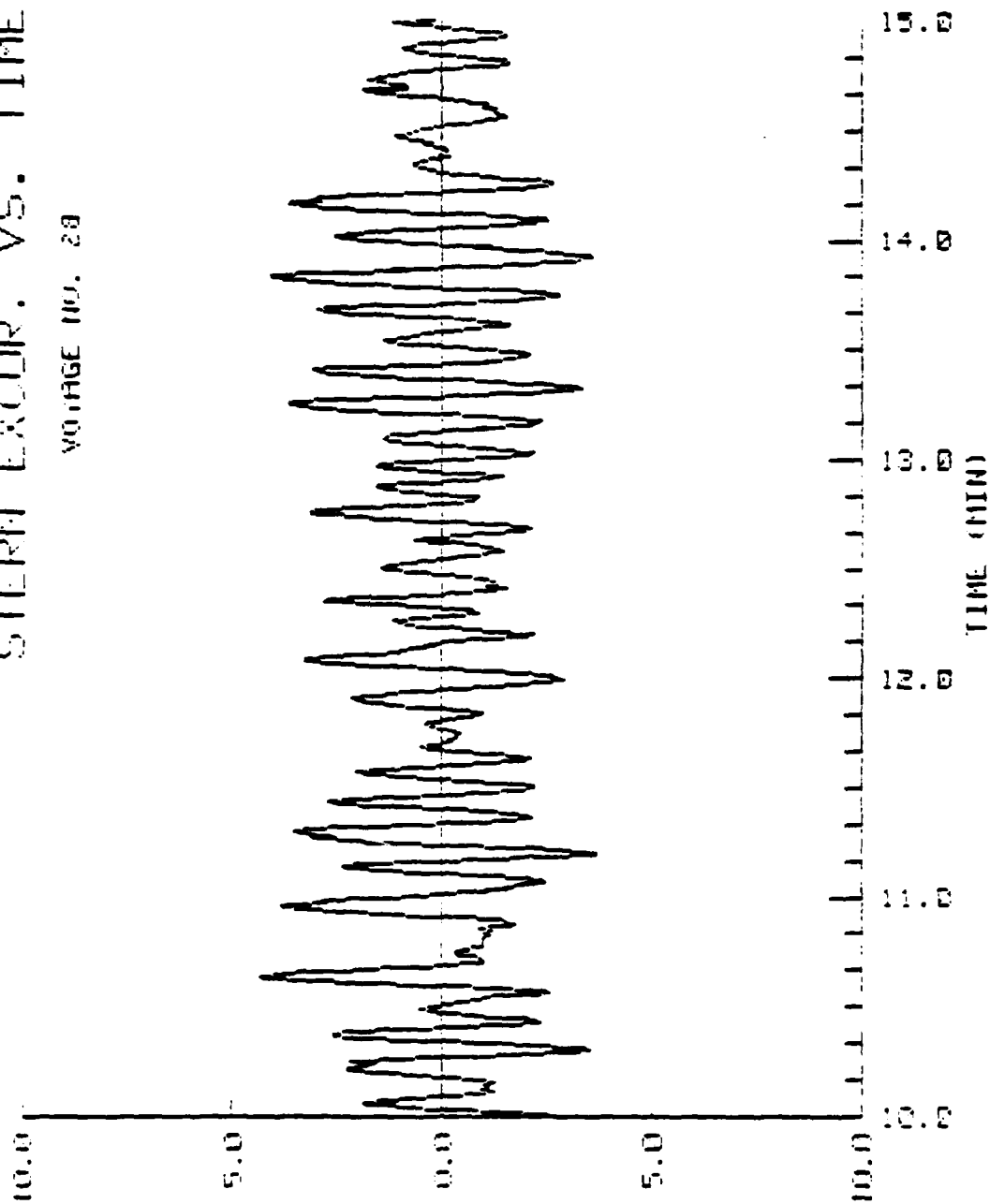
VOLAGE NO. 28





STERN EXCUR. VS. TIME

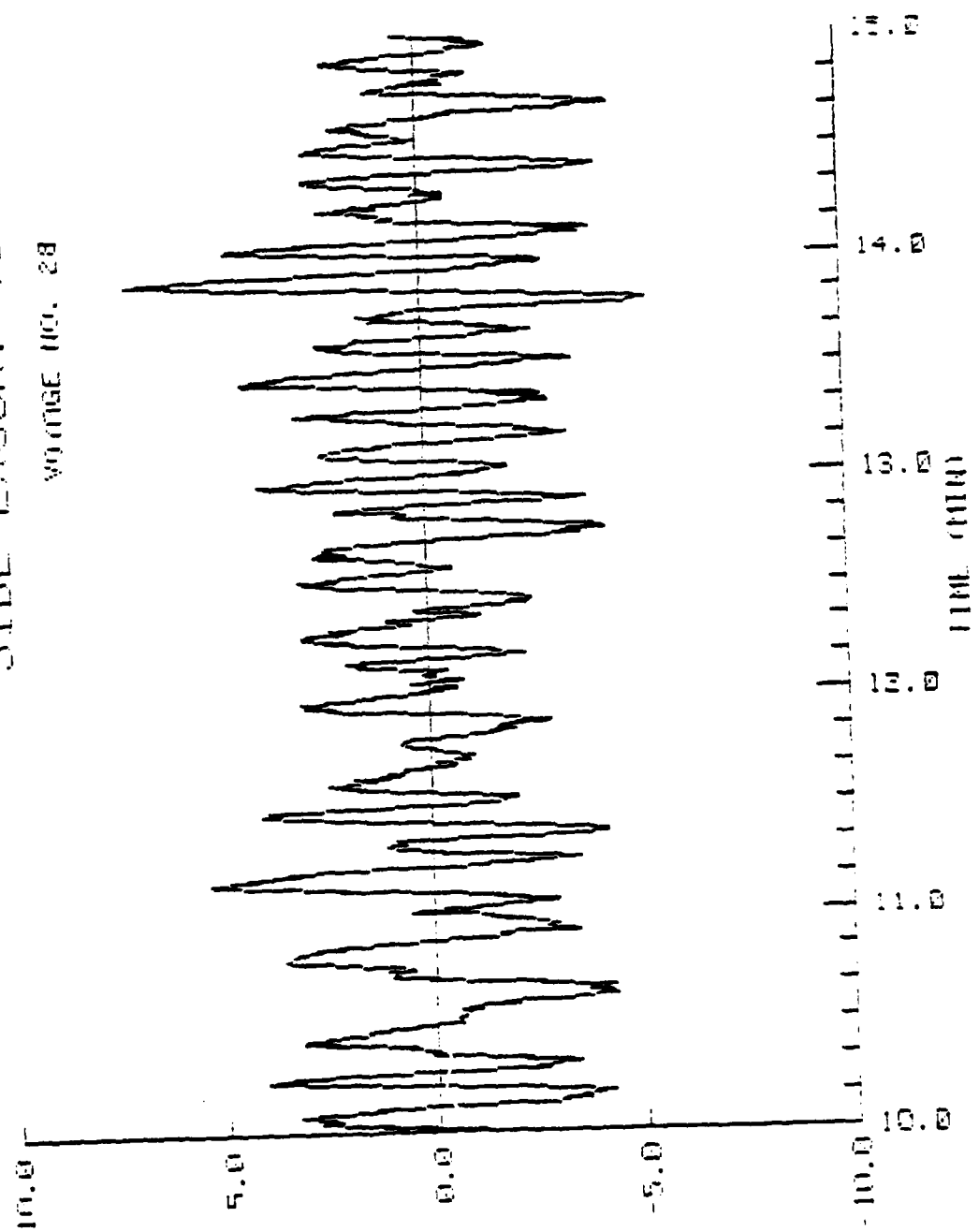
VOLUME NO. 28





# SIDE EXCUR. VS. TIME

VOLUME NO. 28



11-15-68 10:00 AM



# STATISTICAL SUMMARY

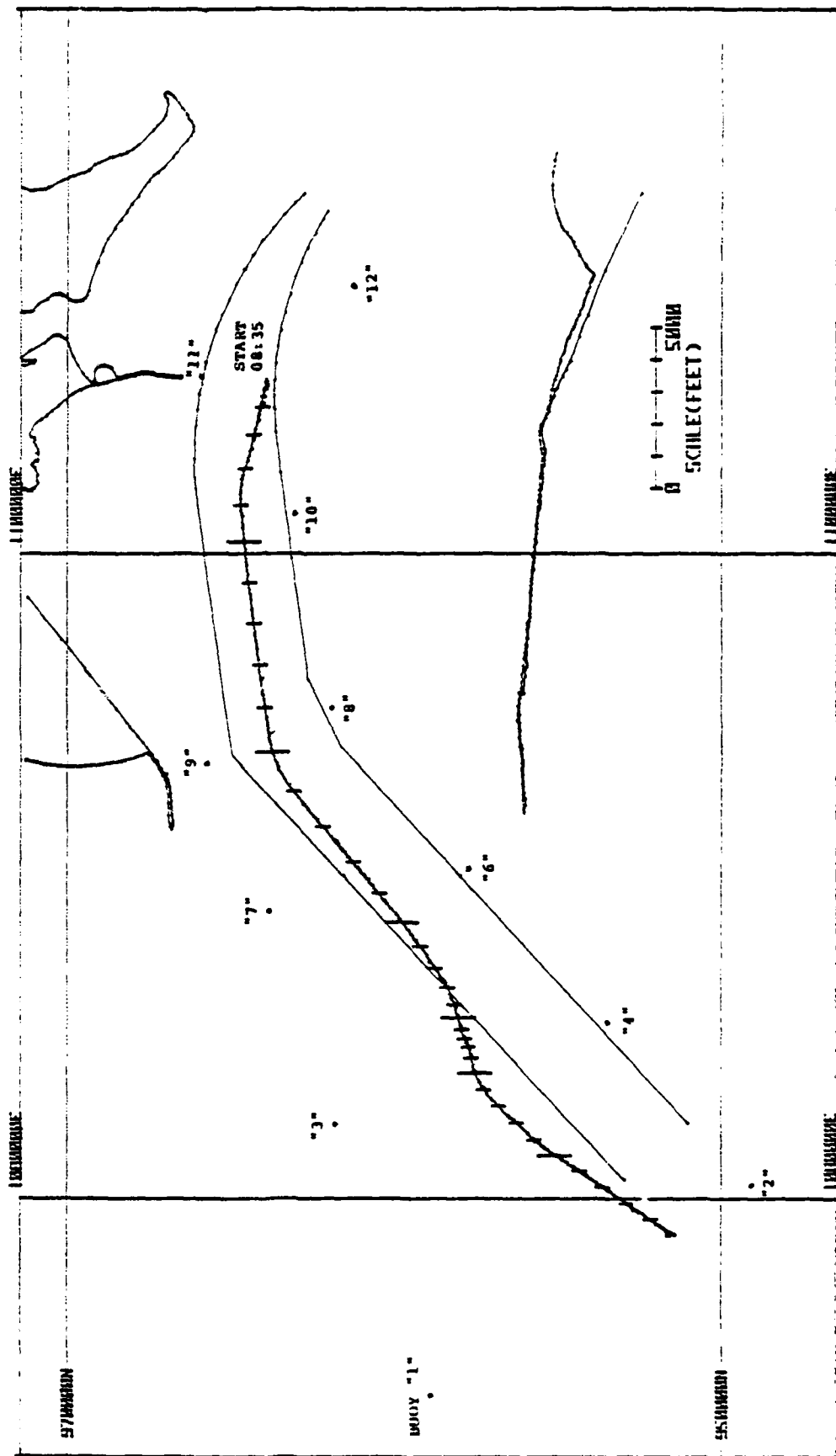
VOYAGE NO. 29

	MEAN LINE DEVIATION FROM ZERO	MAXIMUM AMPLITUDE	AVERAGE AMPLITUDE	RMS
PITCH (DEG)	.1	1.8	.7	.8
ROLL (DEG)	.2	3.7	1.0	1.2
NO. (FT/SEC/SEC)	-.0	2.5	.8	.9
HEAVE (FT)	.0	5.5	1.9	2.2
BOW EXCUR. (FT)	.0	15.2	5.1	6.0
STERN EXCUR. (FT)	.0	6.5	2.1	2.4
SIDE EXCUR (FT)	.0	4.8	2.0	2.2



# VOYAGE NO. 29 SHIP TRACK

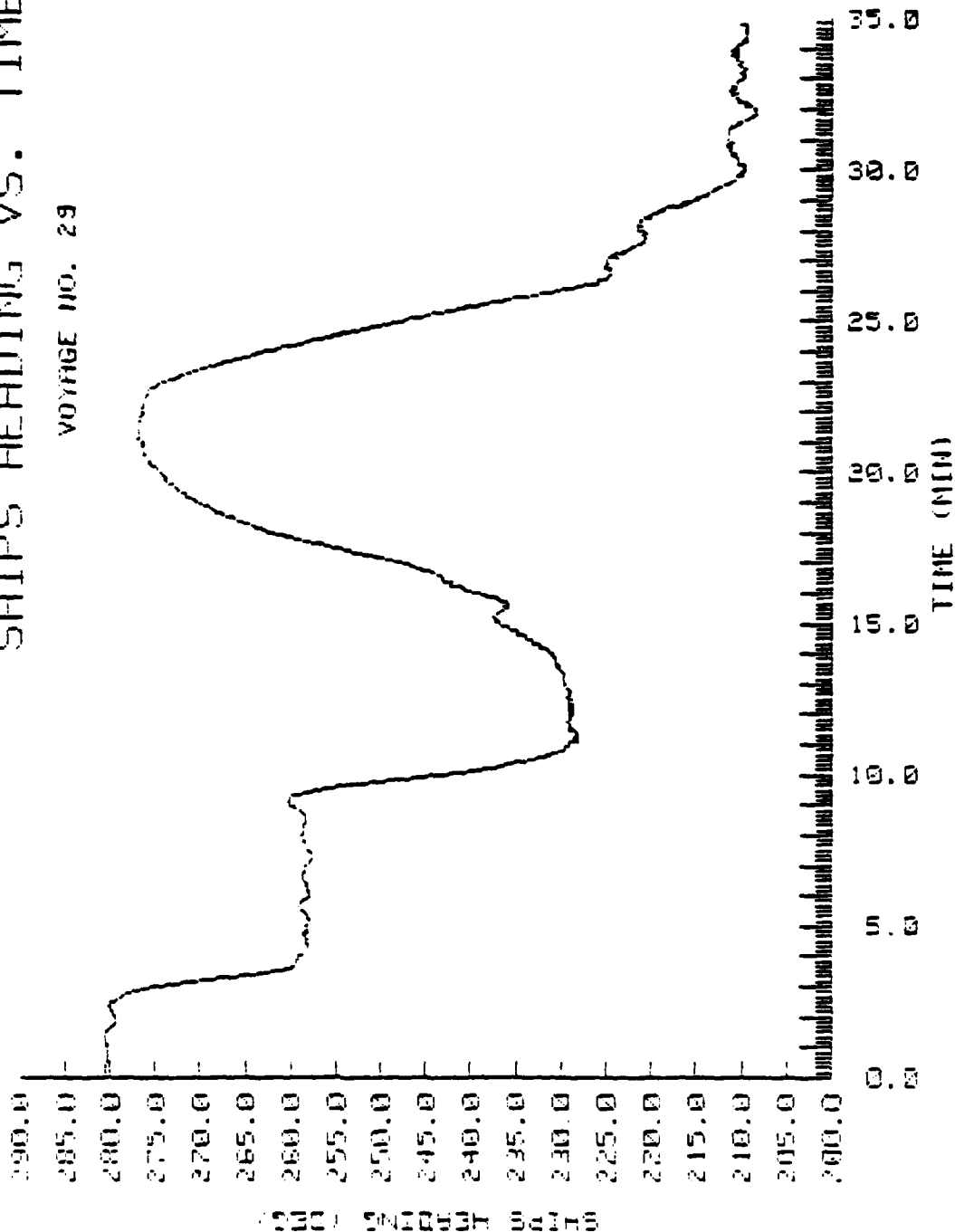
DATE: 1 JUL 55





# SHIPS HEADING VS. TIME

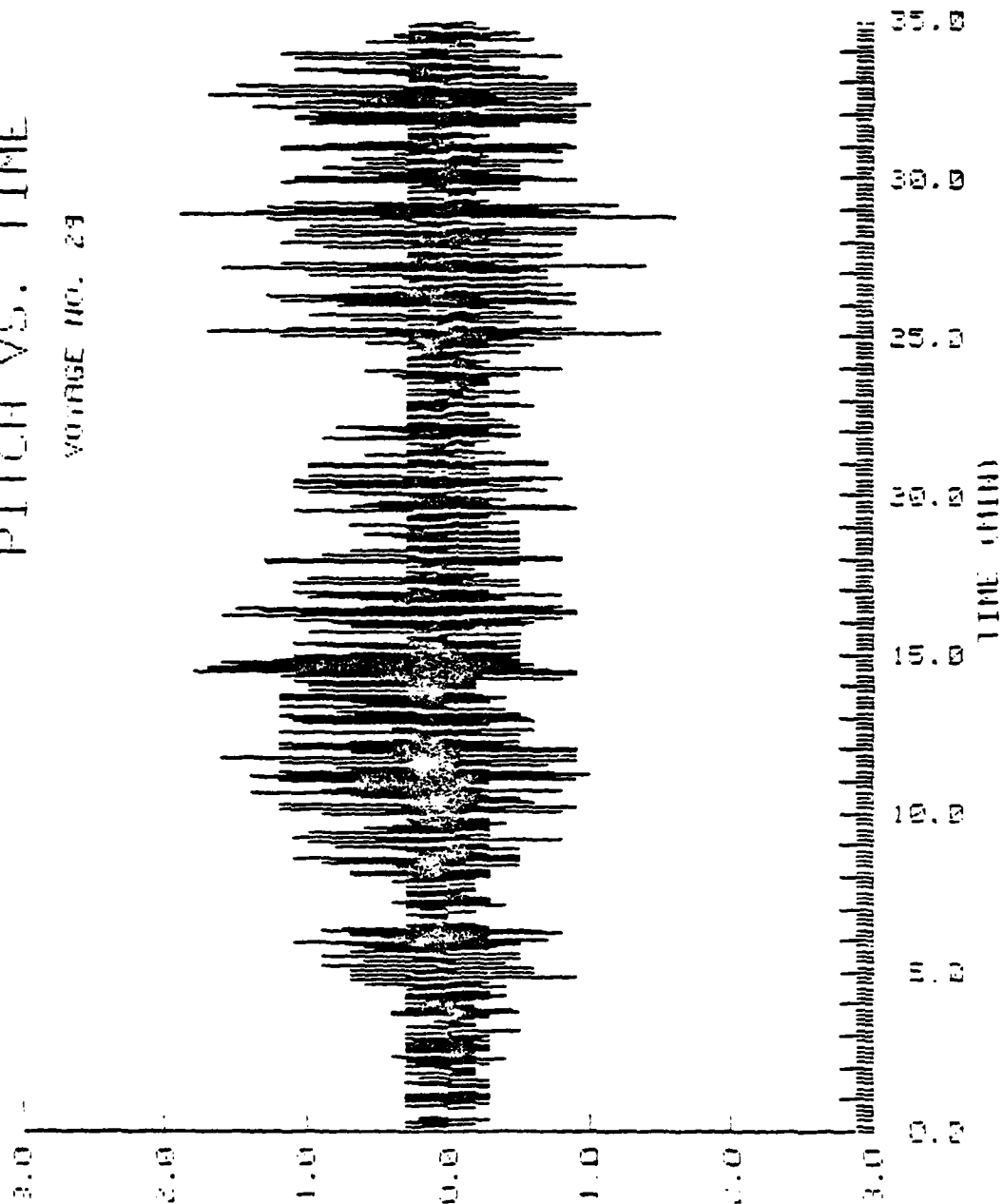
VOYAGE NO. 29





# PITCH VS. TIME

VOLUME NO. 29

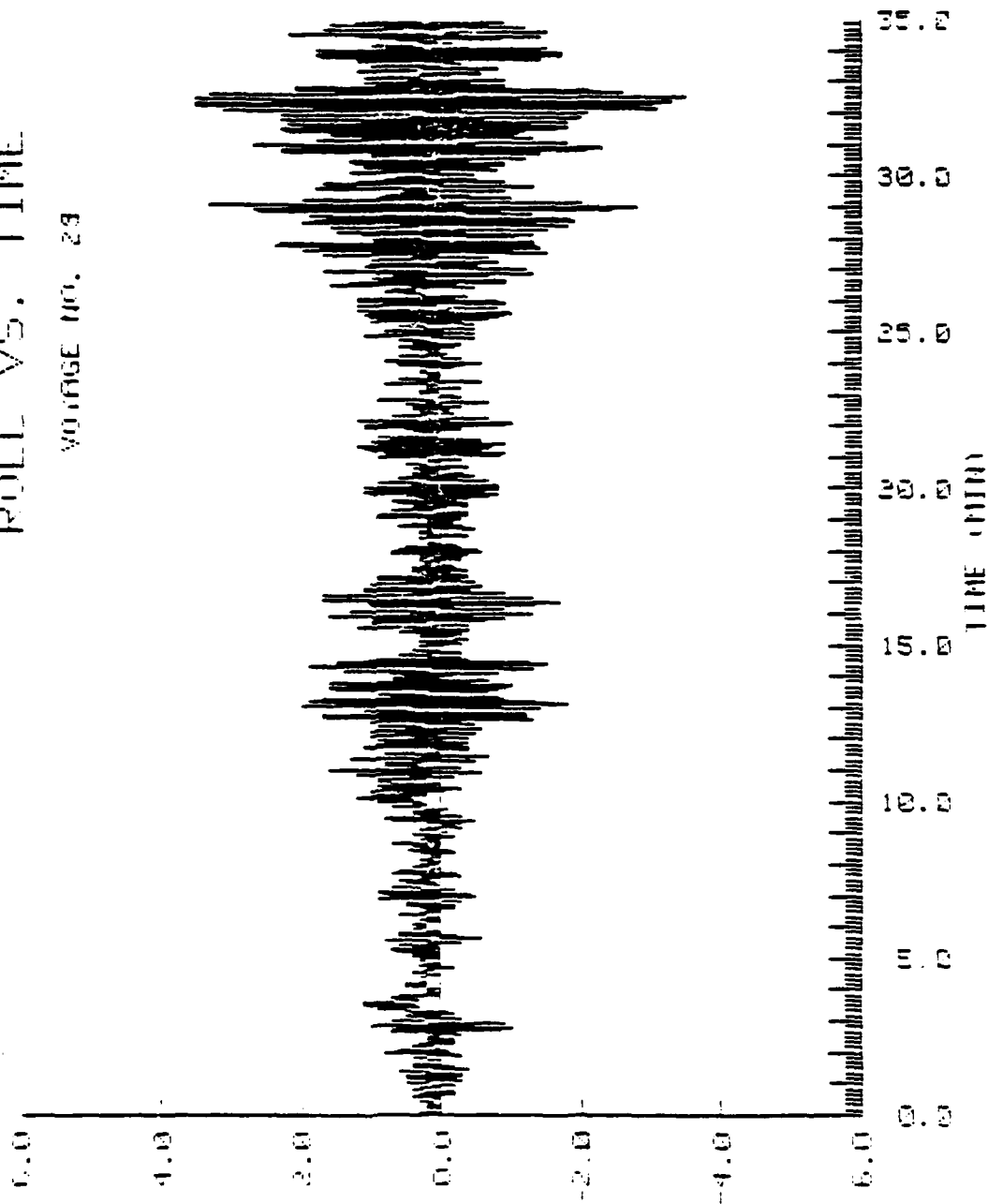


100-10000



# ROLL VS. TIME

VOLUME NO. 23

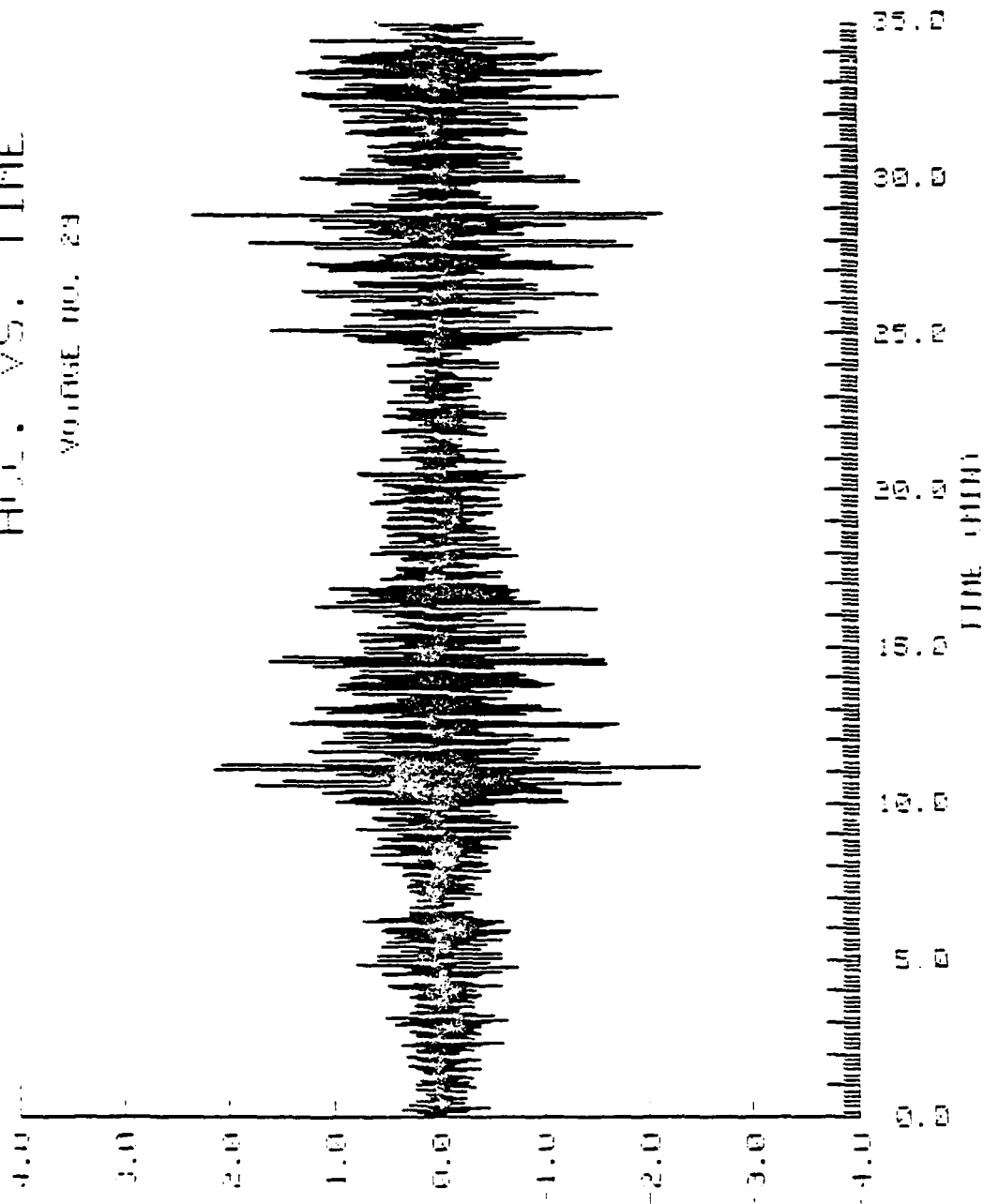


ROLL (DEG)



# REC. VS. TIME

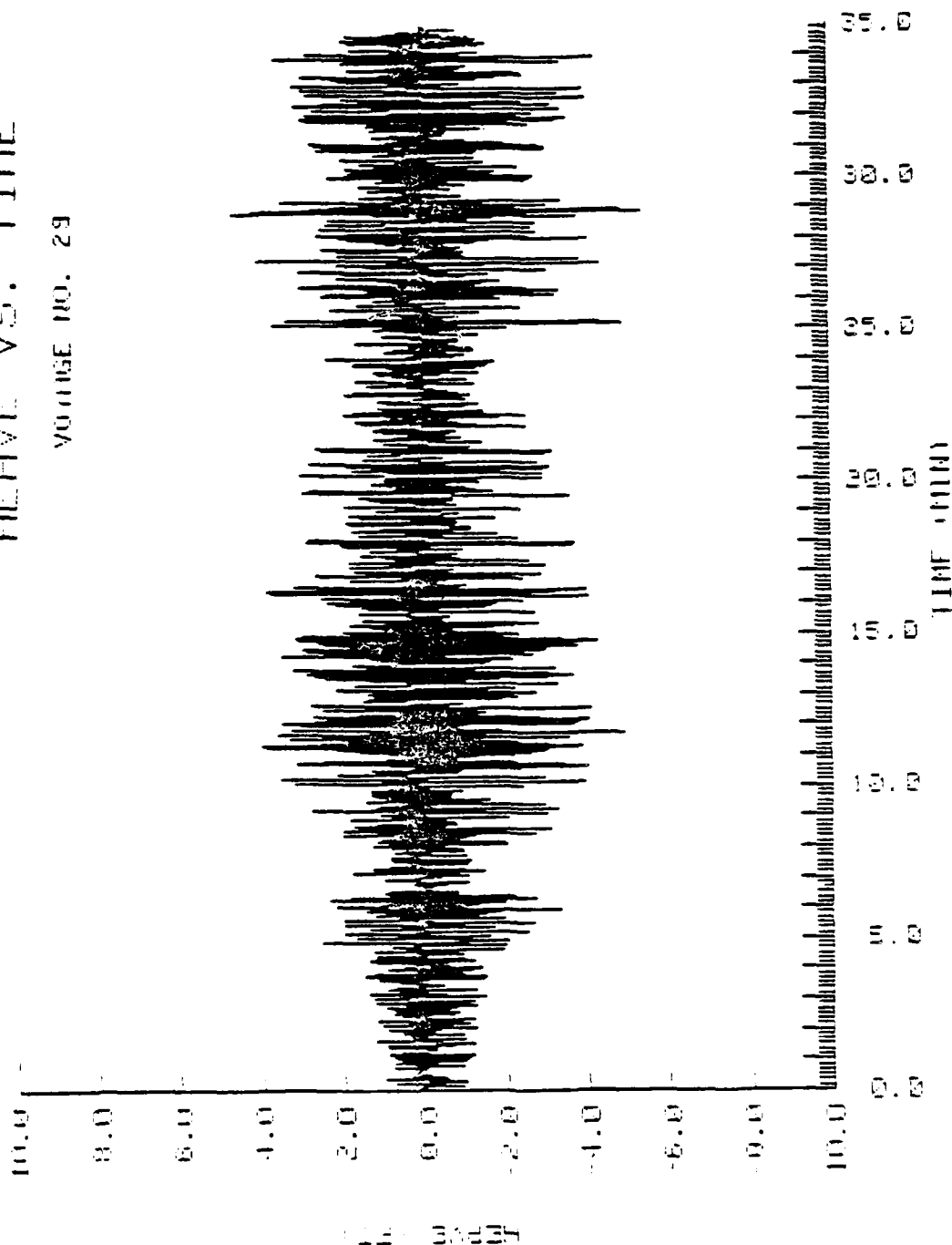
VOLUME NO. 23





# HEAVE VS. TIME

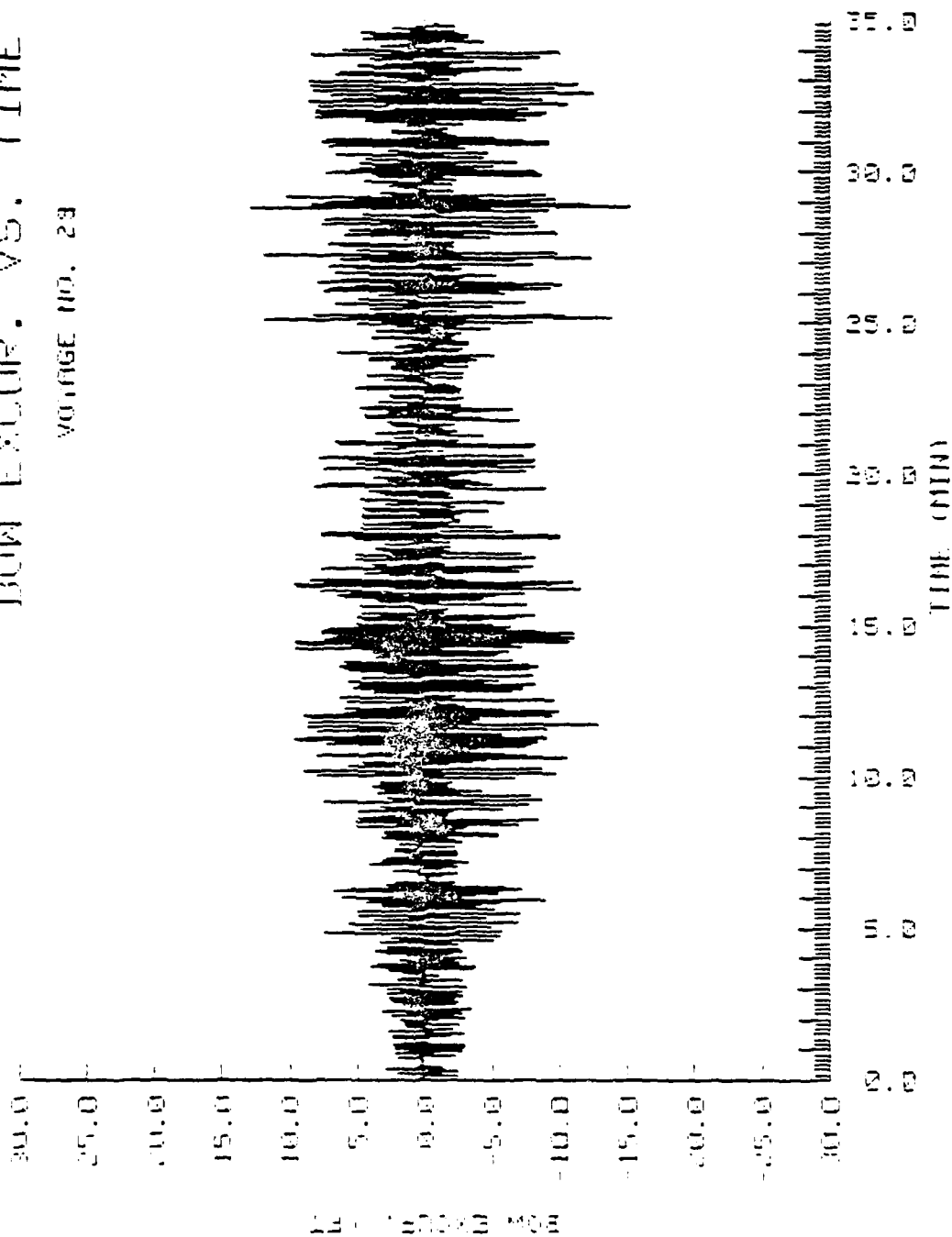
VOISE NO. 29





# BOH EXCUR. VS. TIME

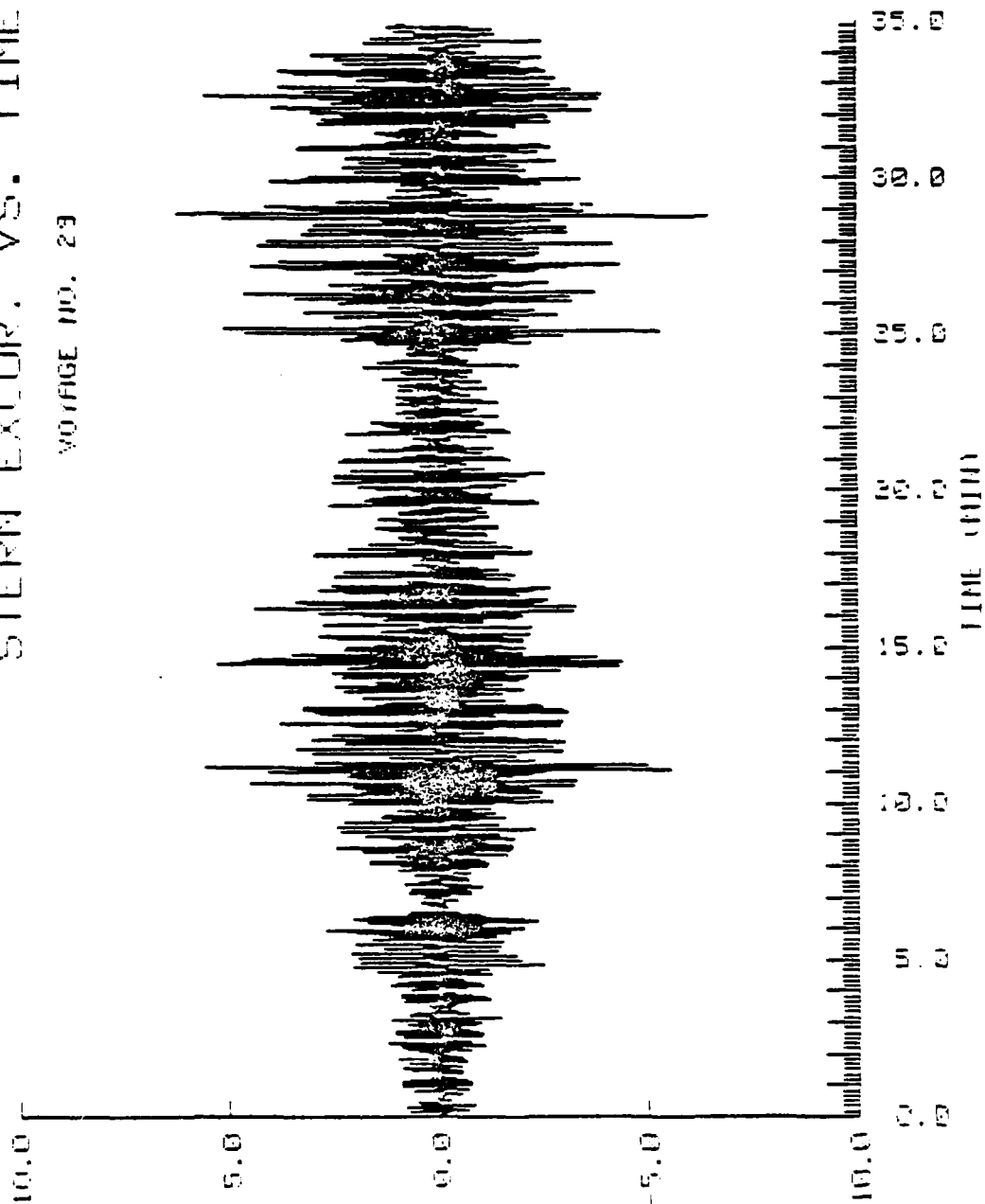
VOLUME NO. 23





# STERN EXCUR. VS. TIME

VOLUME NO. 23

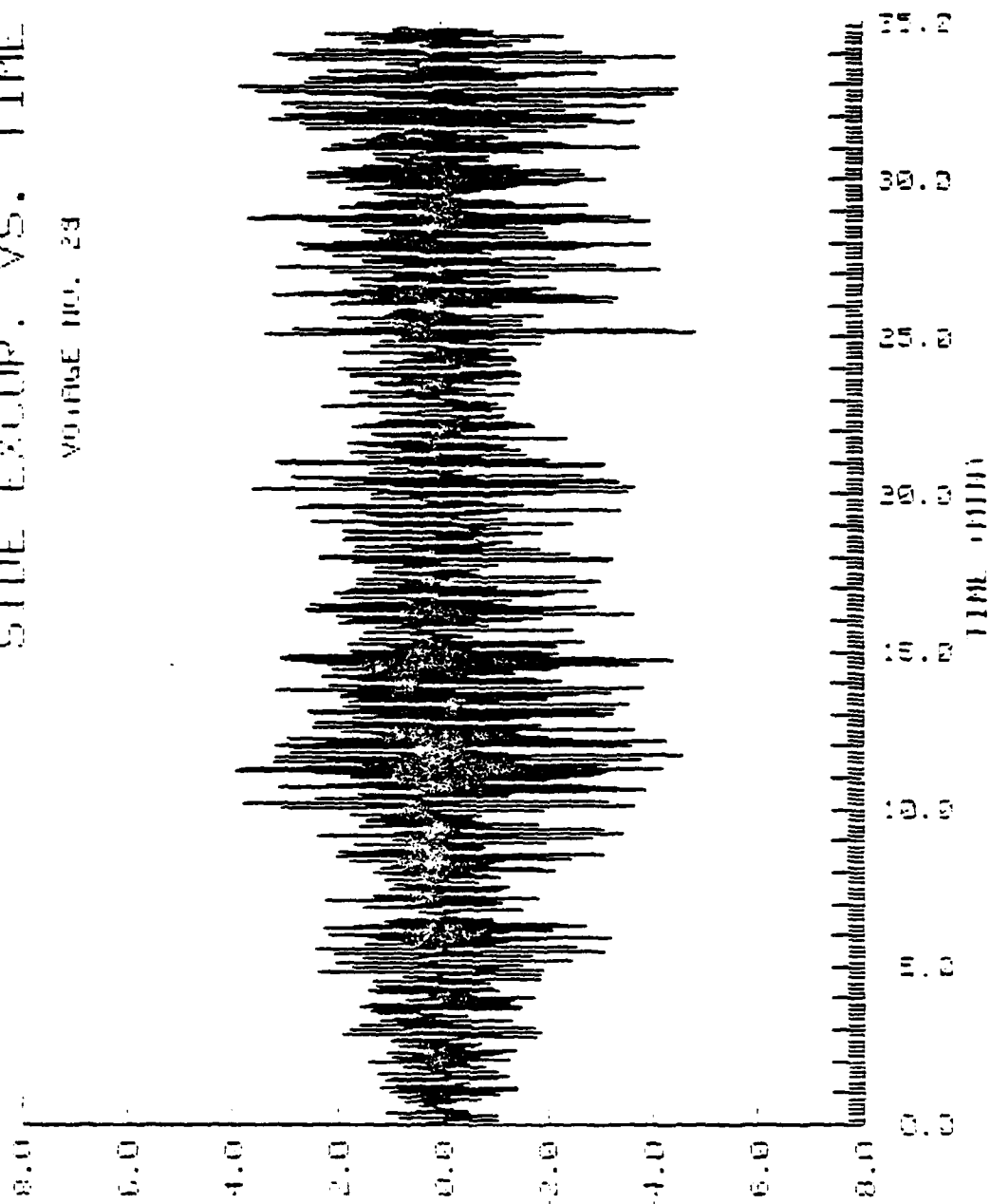


STERN EXCUR. VS. TIME



# SIDE EXCUR. VS. TIME

VOLUME NO. 23



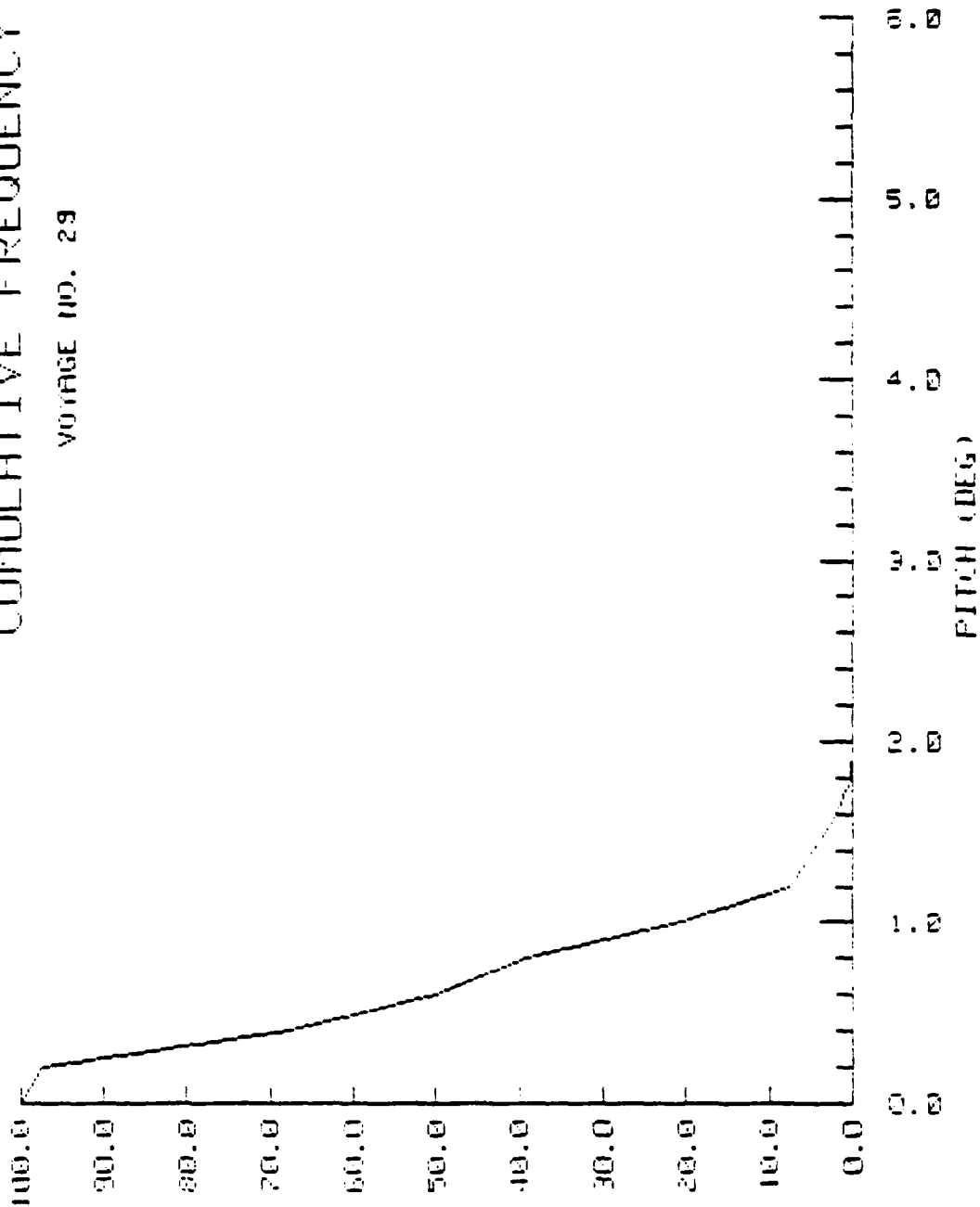
SIDE EXCUR. (FT)

TIME (MIN)



# CUMULATIVE FREQUENCY

VOTAGE NO. 29

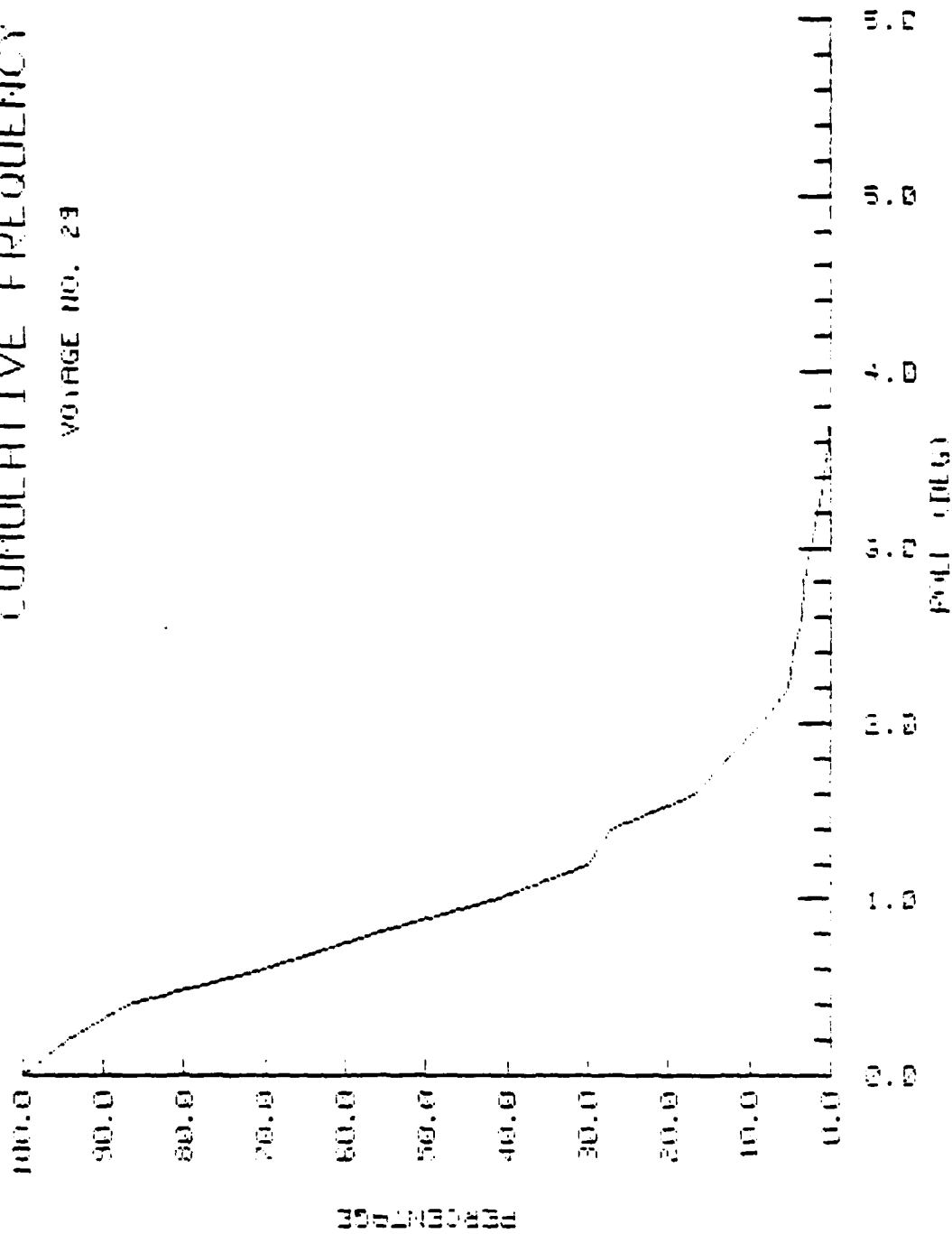


355112433230



# CUMULATIVE FREQUENCY

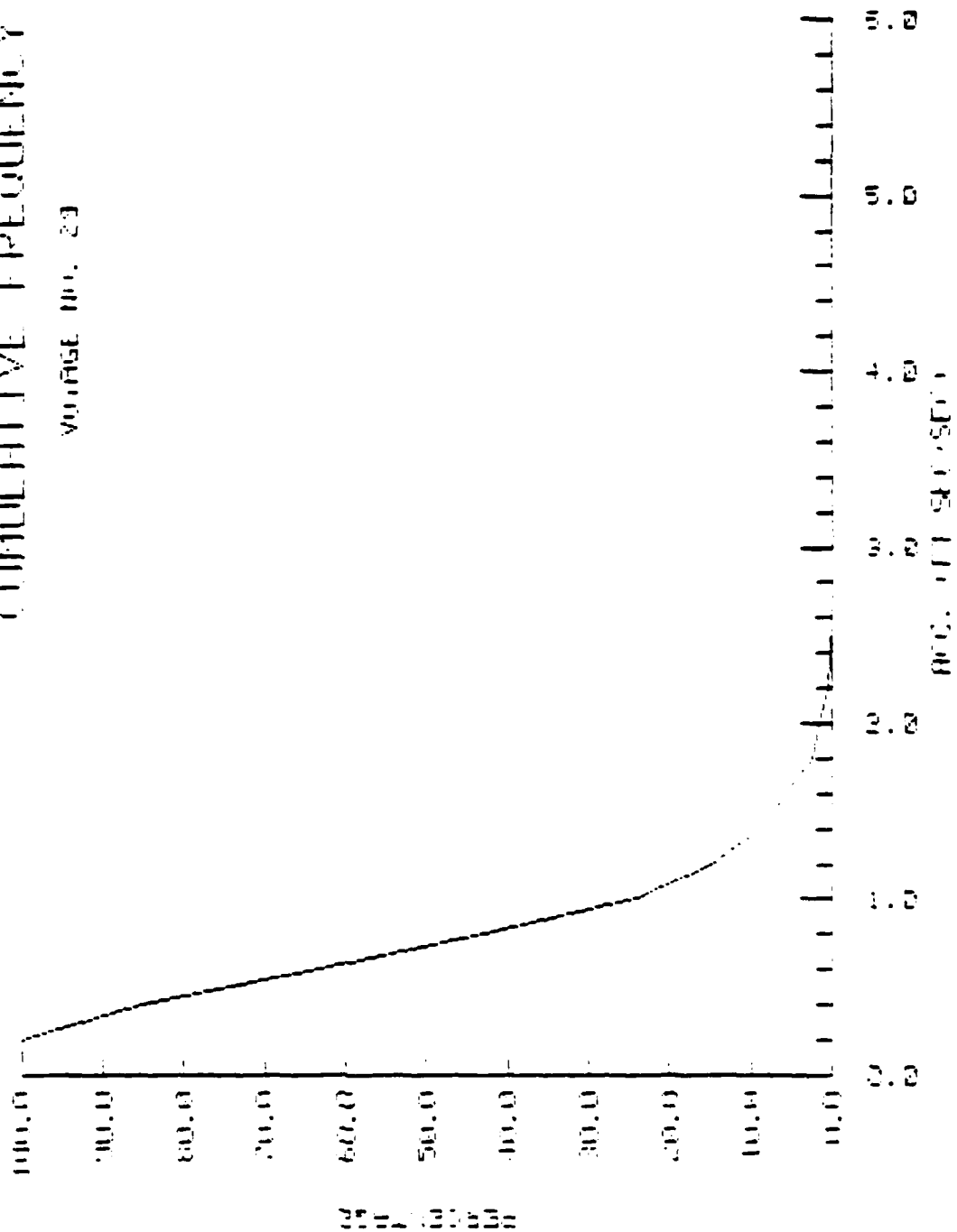
VOLUME NO. 29





# CUMULATIVE FREQUENCY

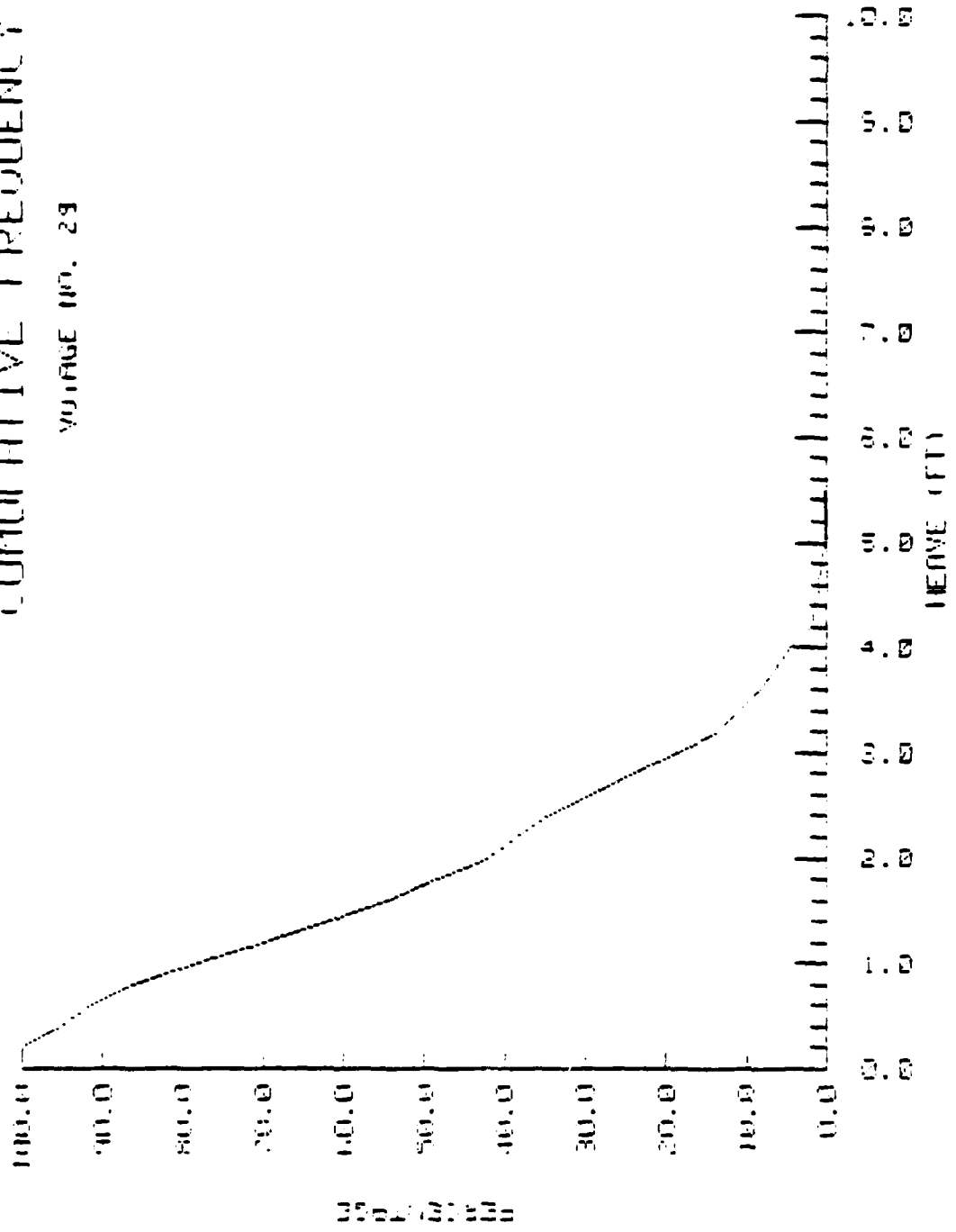
VOLUME NO. 20





# CUMULATIVE FREQUENCY

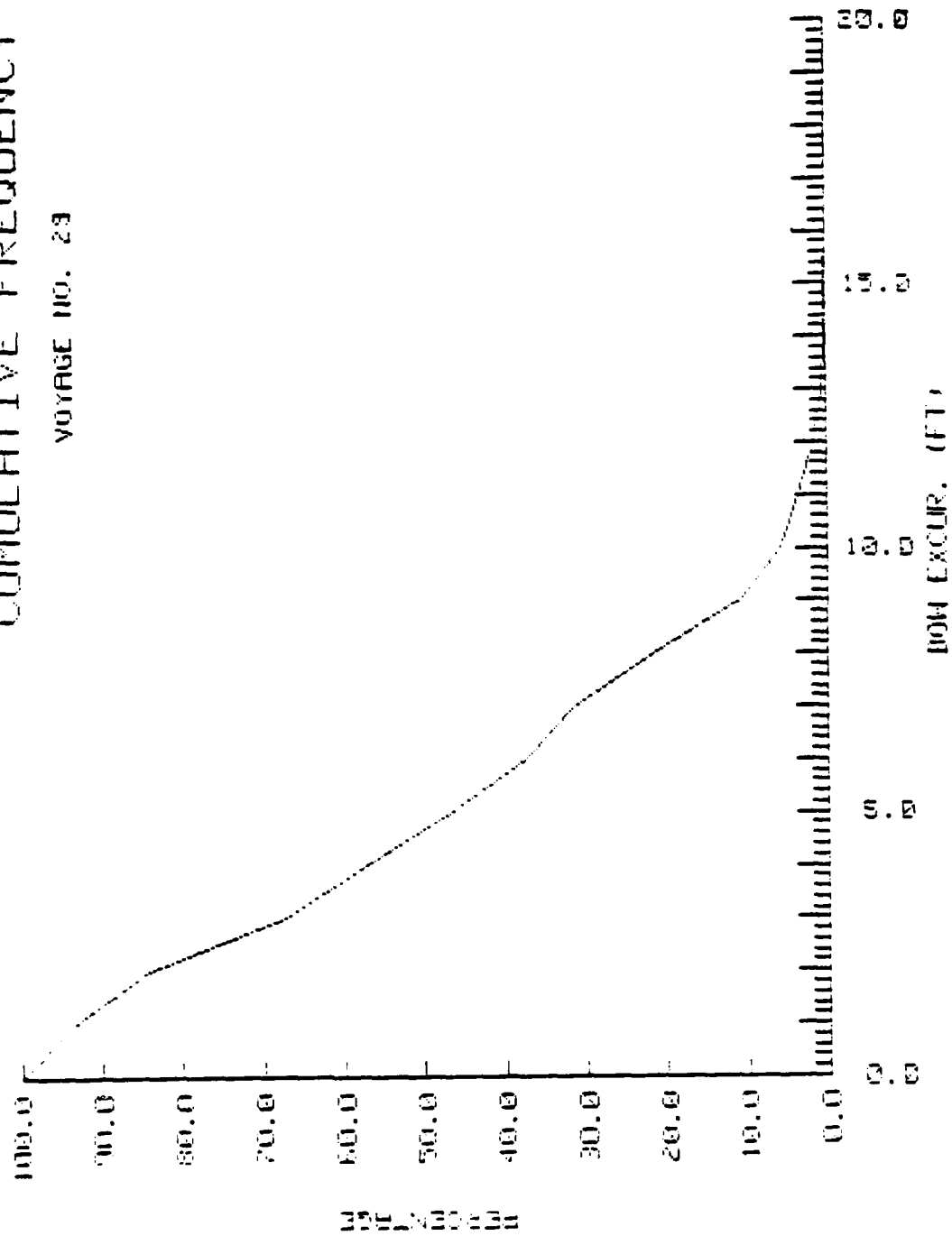
VOLAGE NO. 29





# CUMULATIVE FREQUENCY

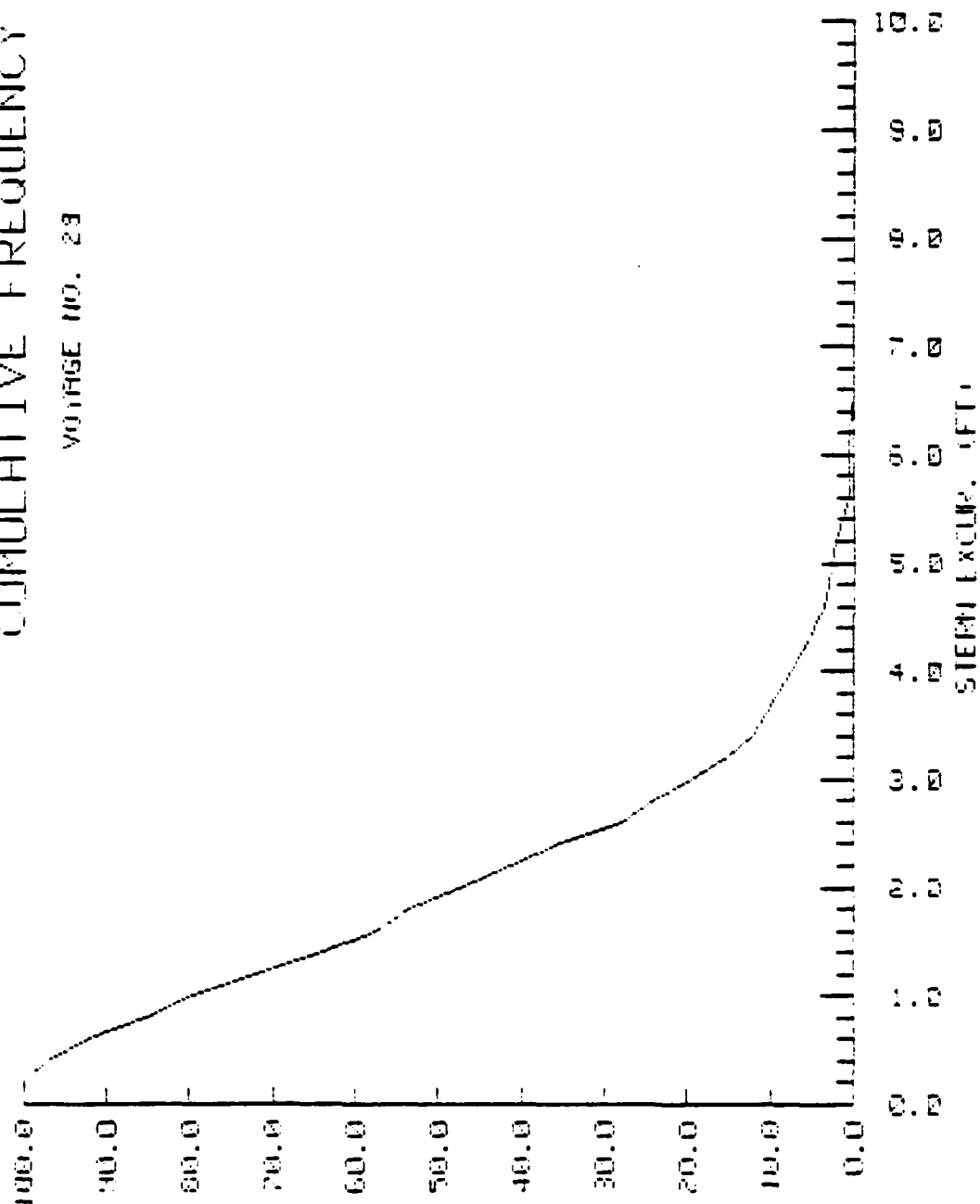
VOYAGE NO. 23





# CUMULATIVE FREQUENCY

VOLUME NO. 23

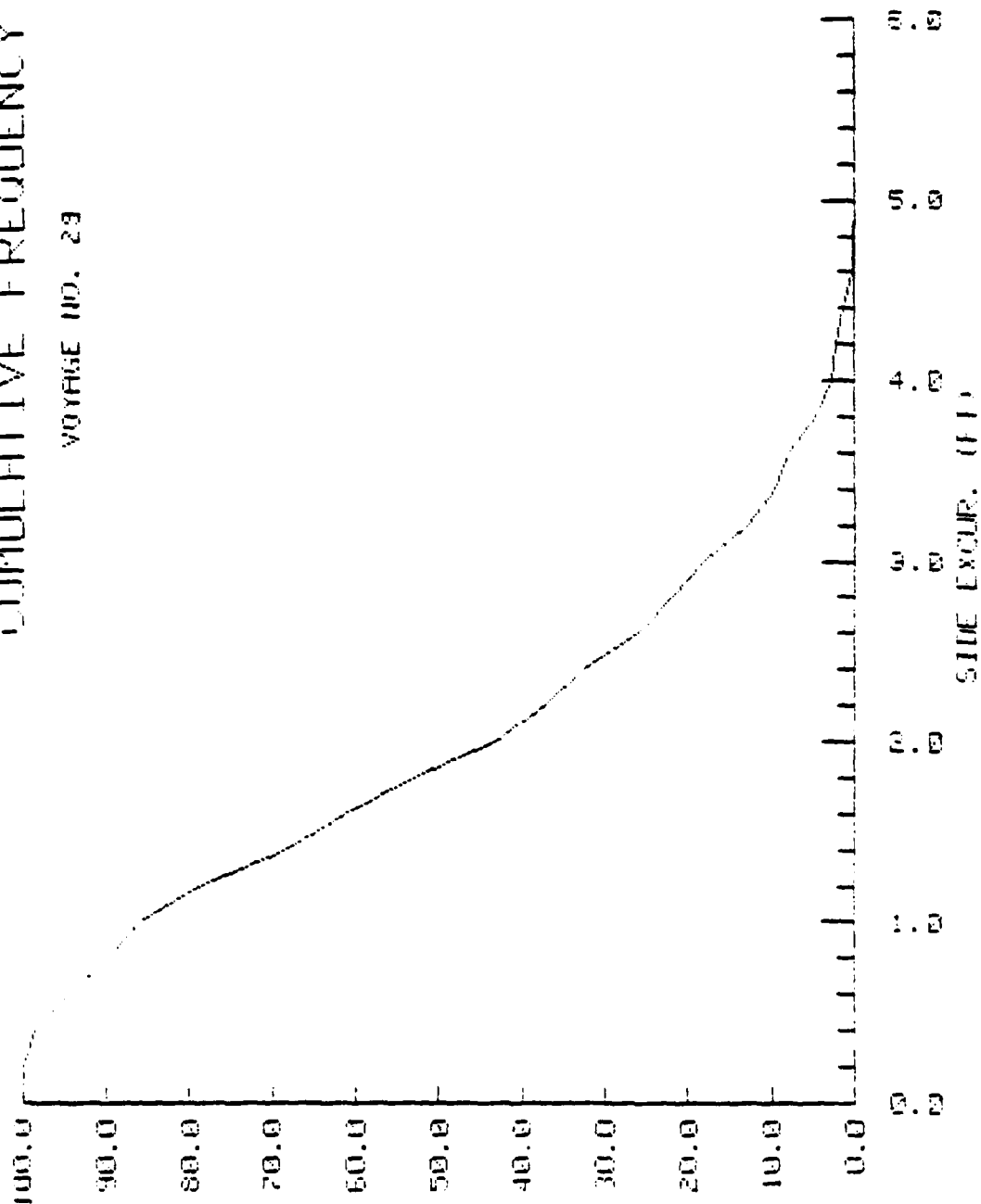


25-17-1308551



# CUMULATIVE FREQUENCY

VOYAGE NO. 23

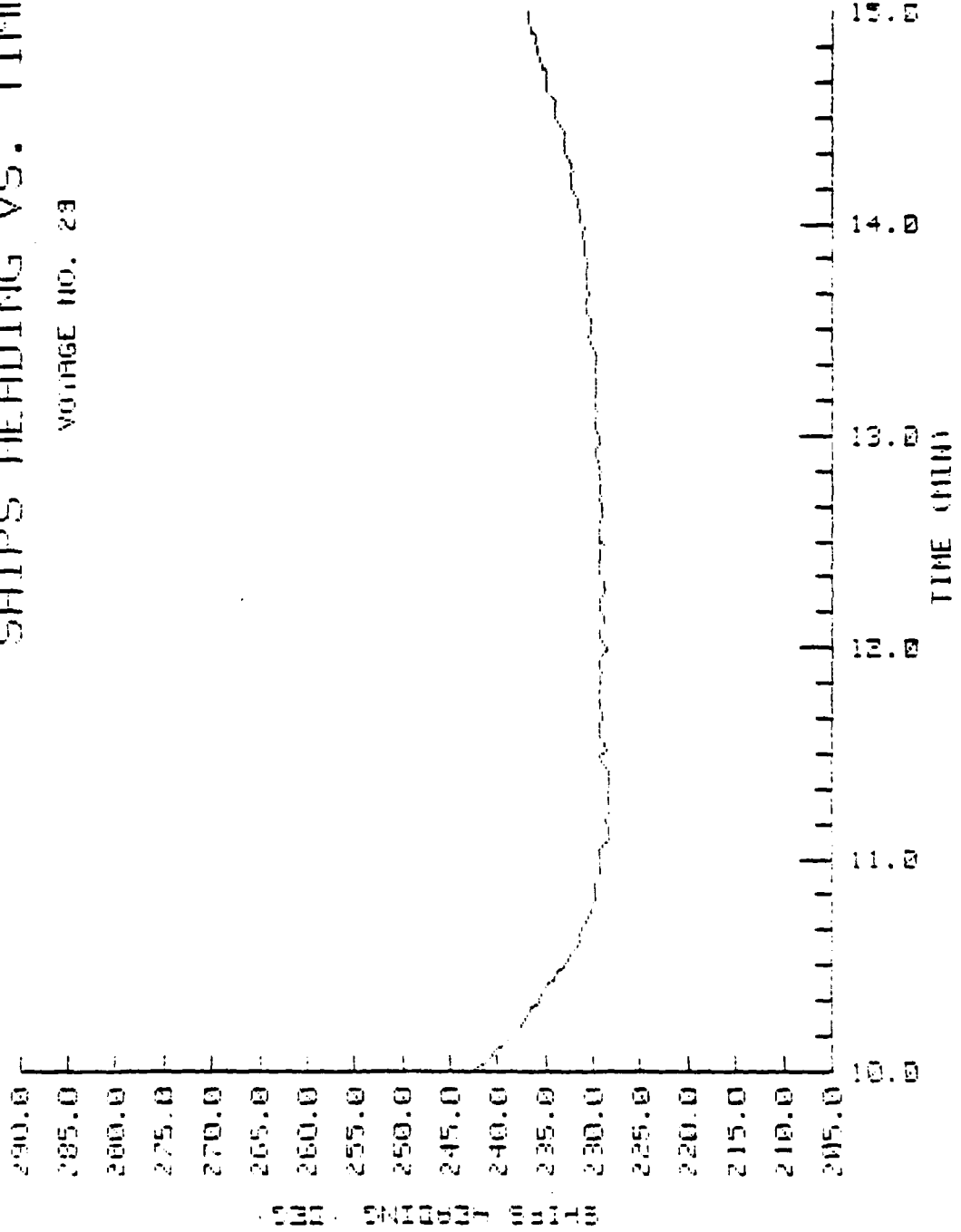


3501250621



# SHIPS HEADING VS. TIME

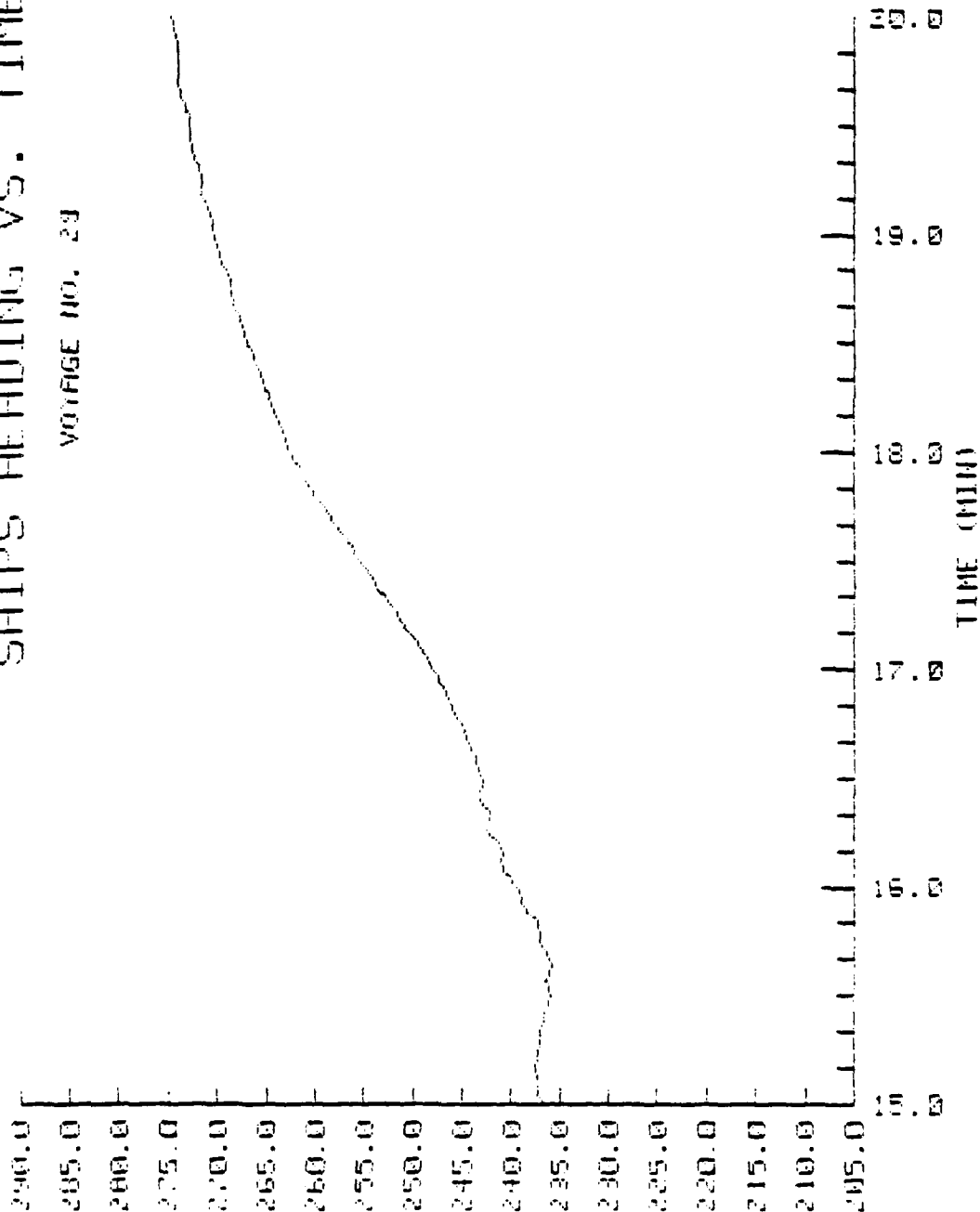
VOTAGE NO. 23





# SHIPS HEADING VS. TIME

Voyage No. 29

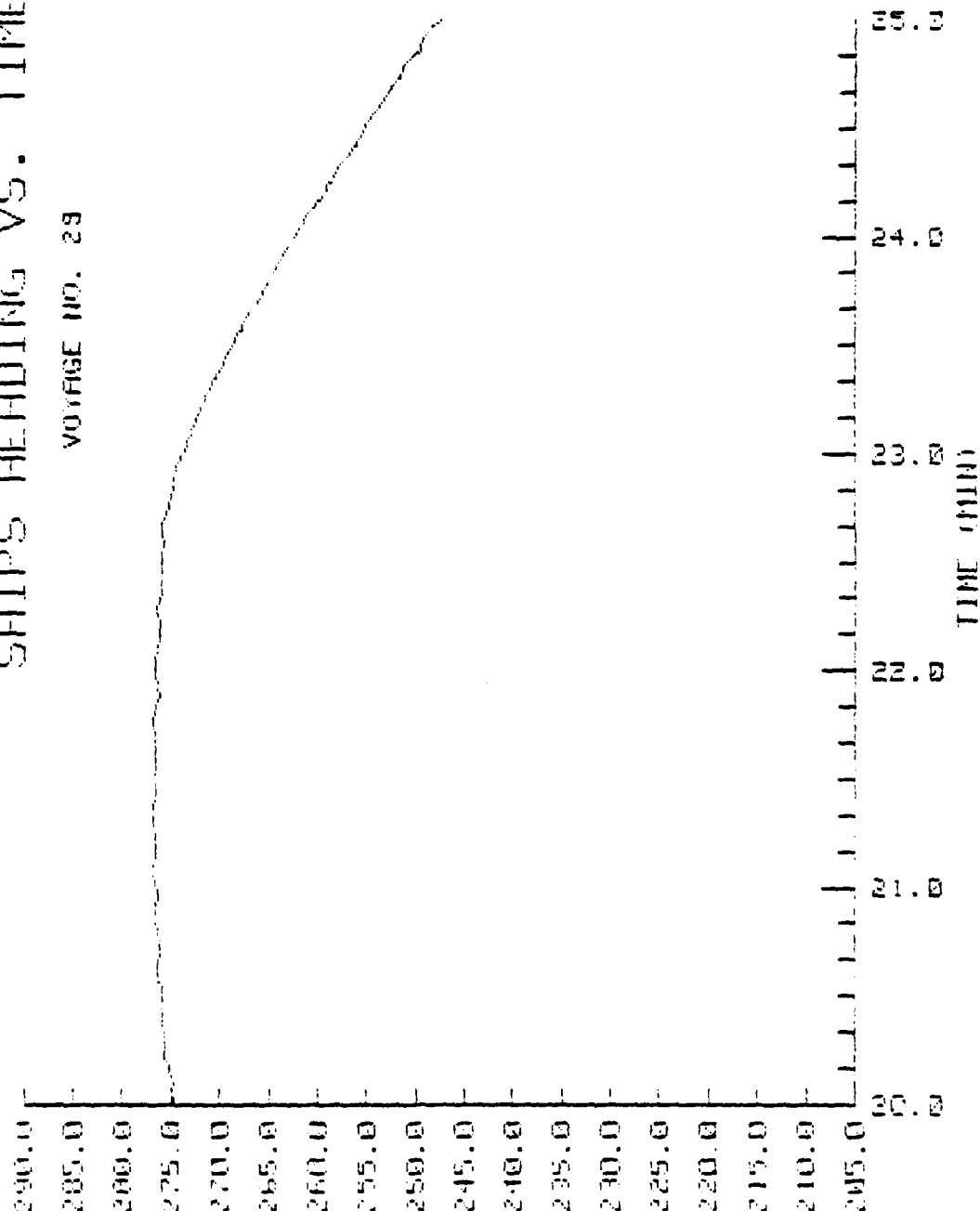


100 100 100 100 100 100 100 100 100 100



# SHIPS HEADING VS. TIME

VOYAGE NO. 29

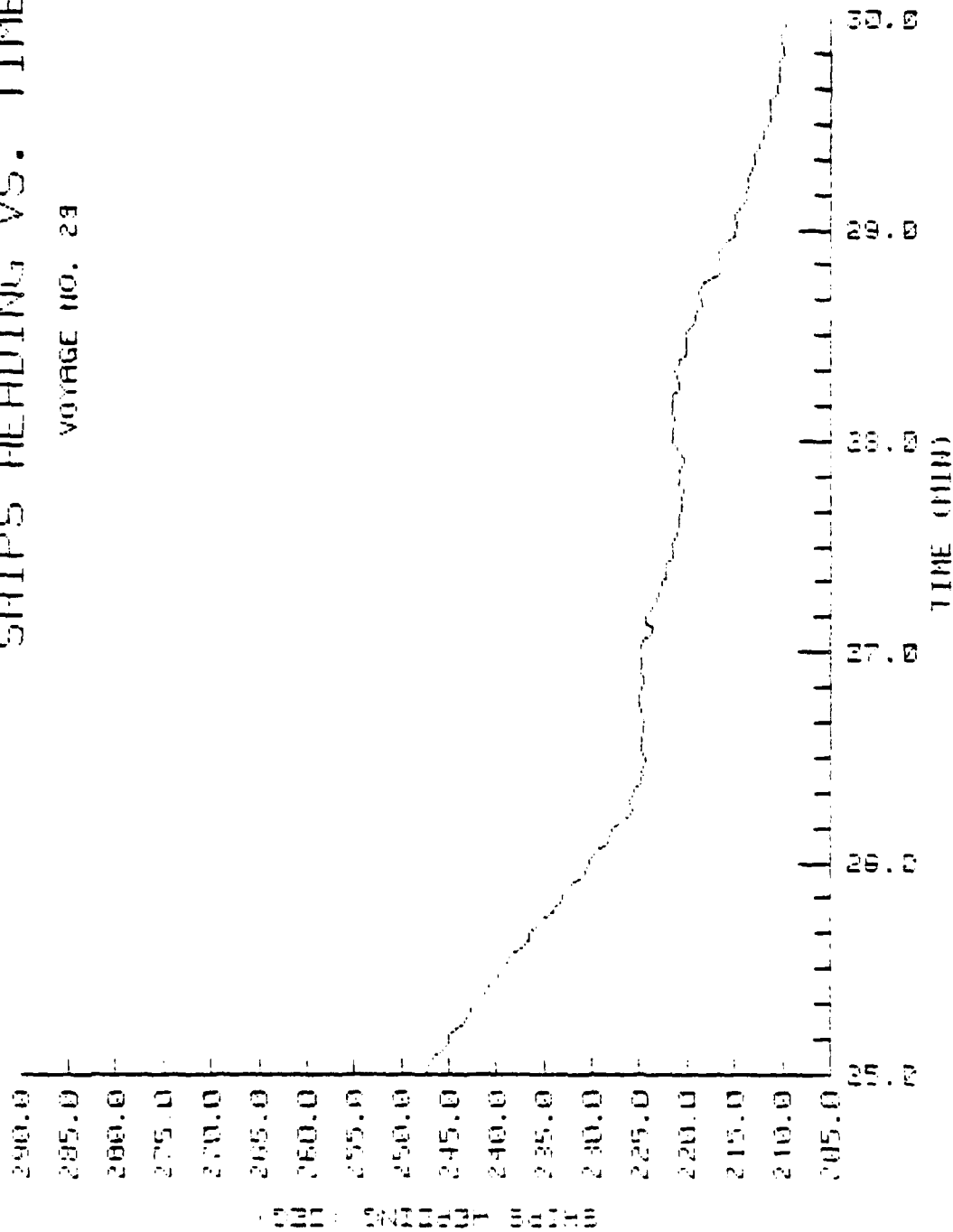


1100 1100 1100 1100 1100 1100 1100 1100 1100 1100



# SHIPS HEADING VS. TIME

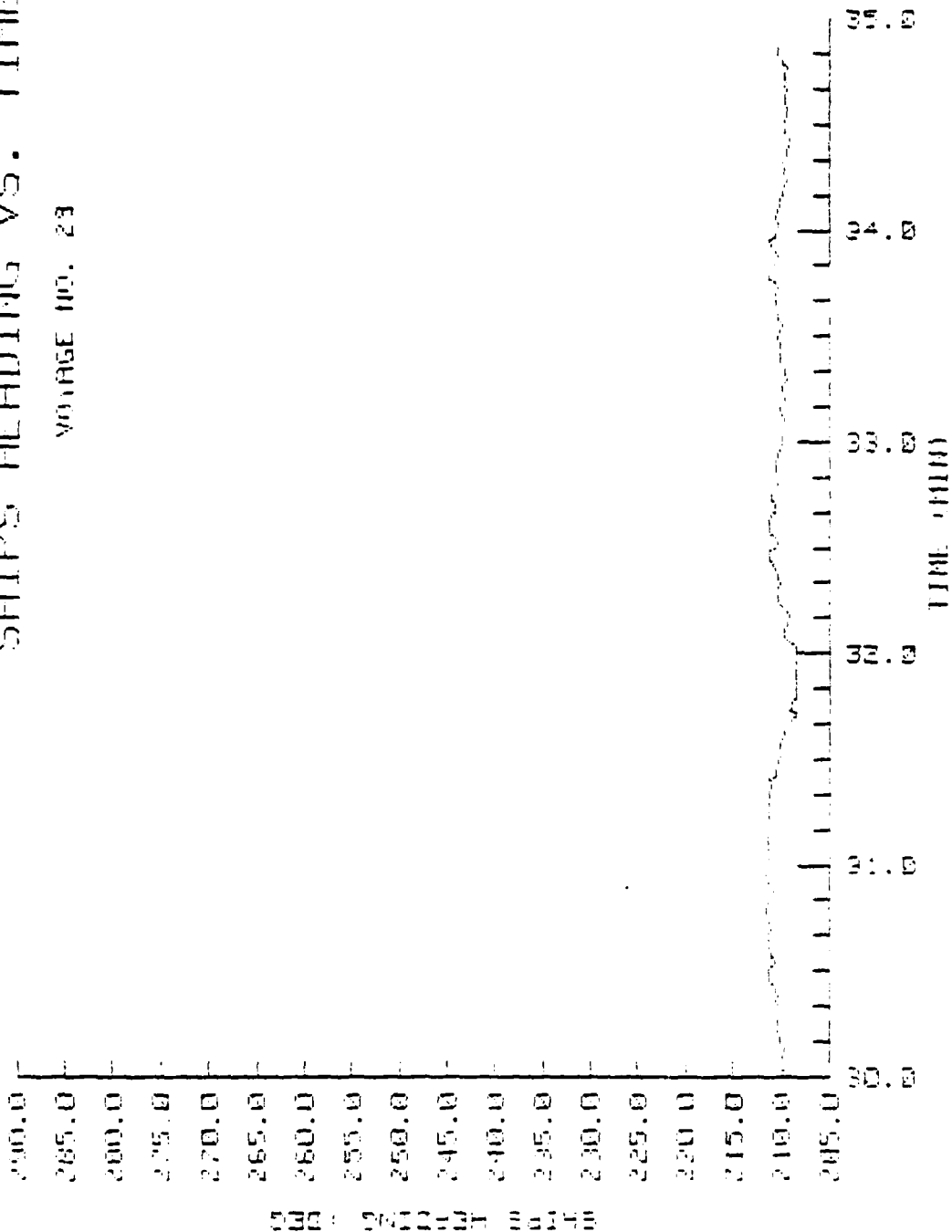
VOYAGE NO. 29





# SHIPS HEADING VS. TIME

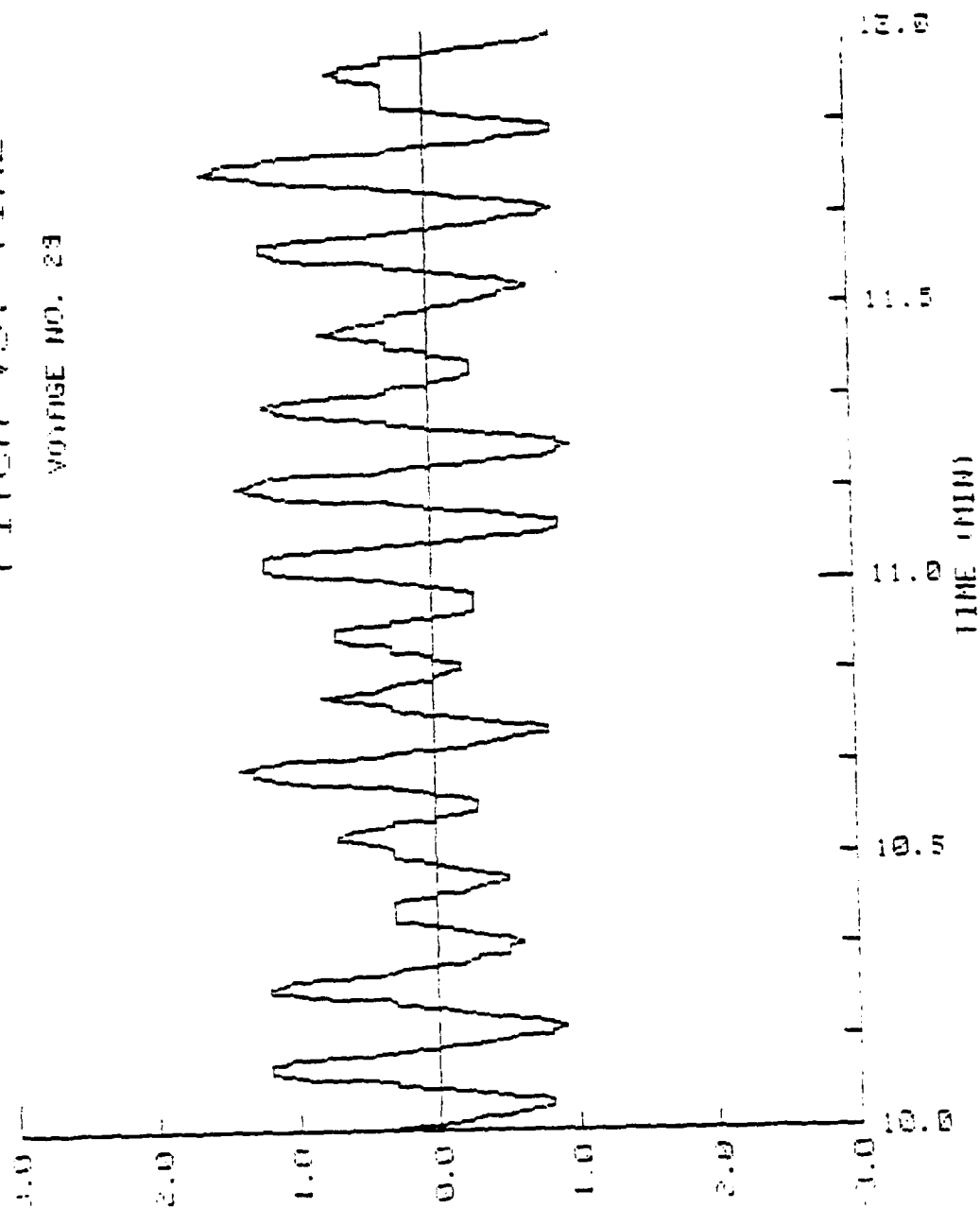
VOYAGE NO. 23





# PITCH VS. TIME

VOLUME NO. 23

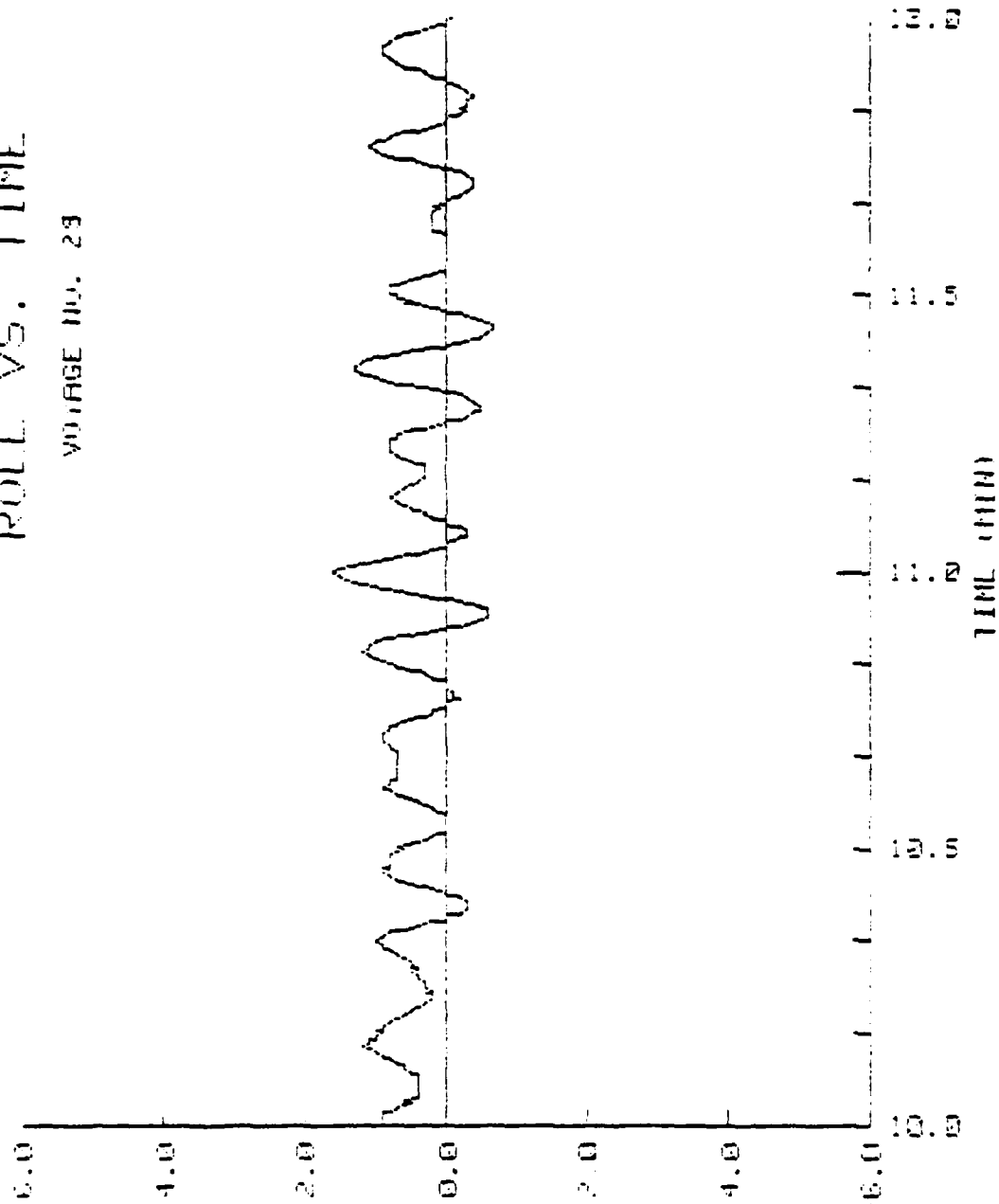


1000 10000



# ROLL VS. TIME

VOLUME NO. 23

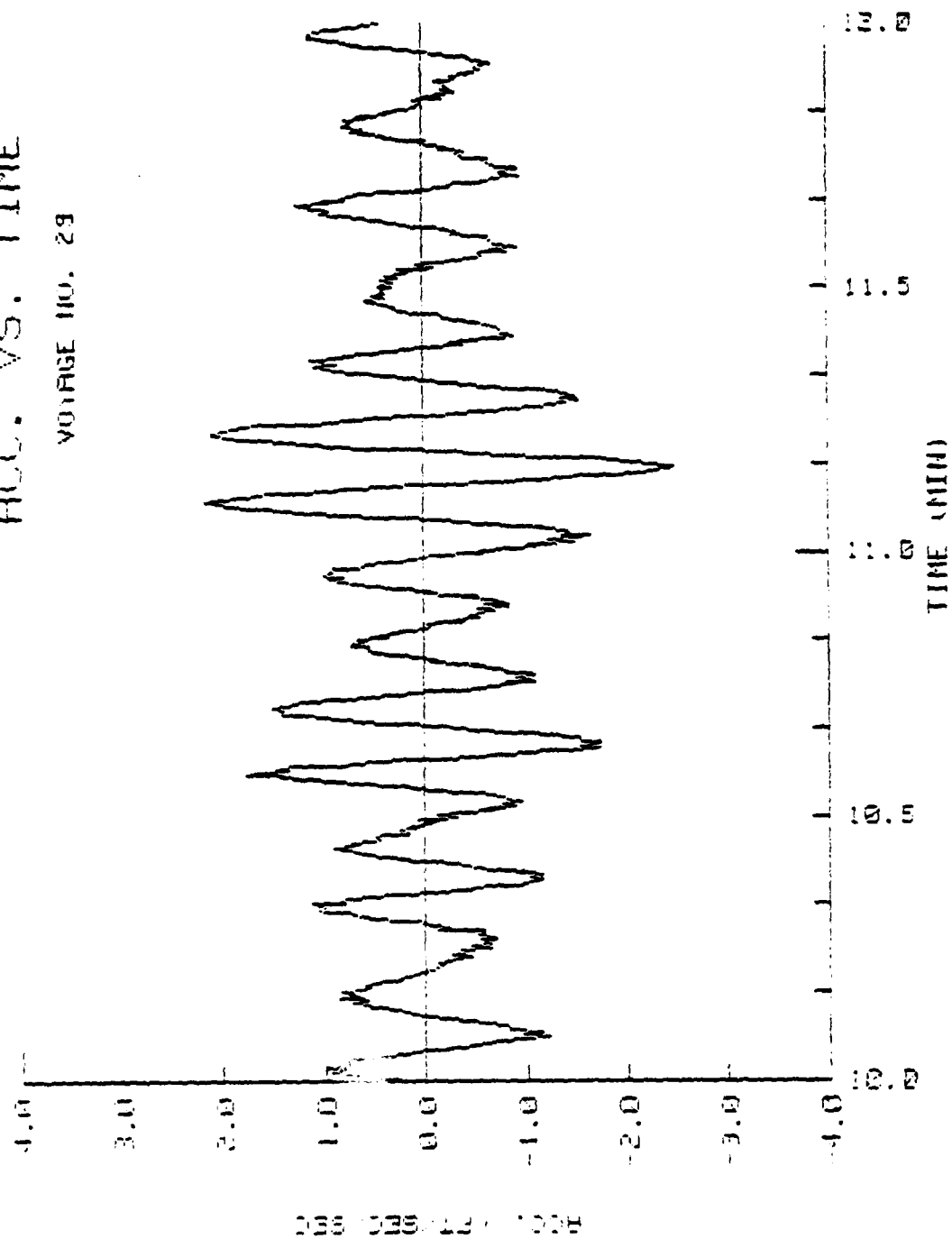


ROLL (DEG)



ACC. VS. TIME

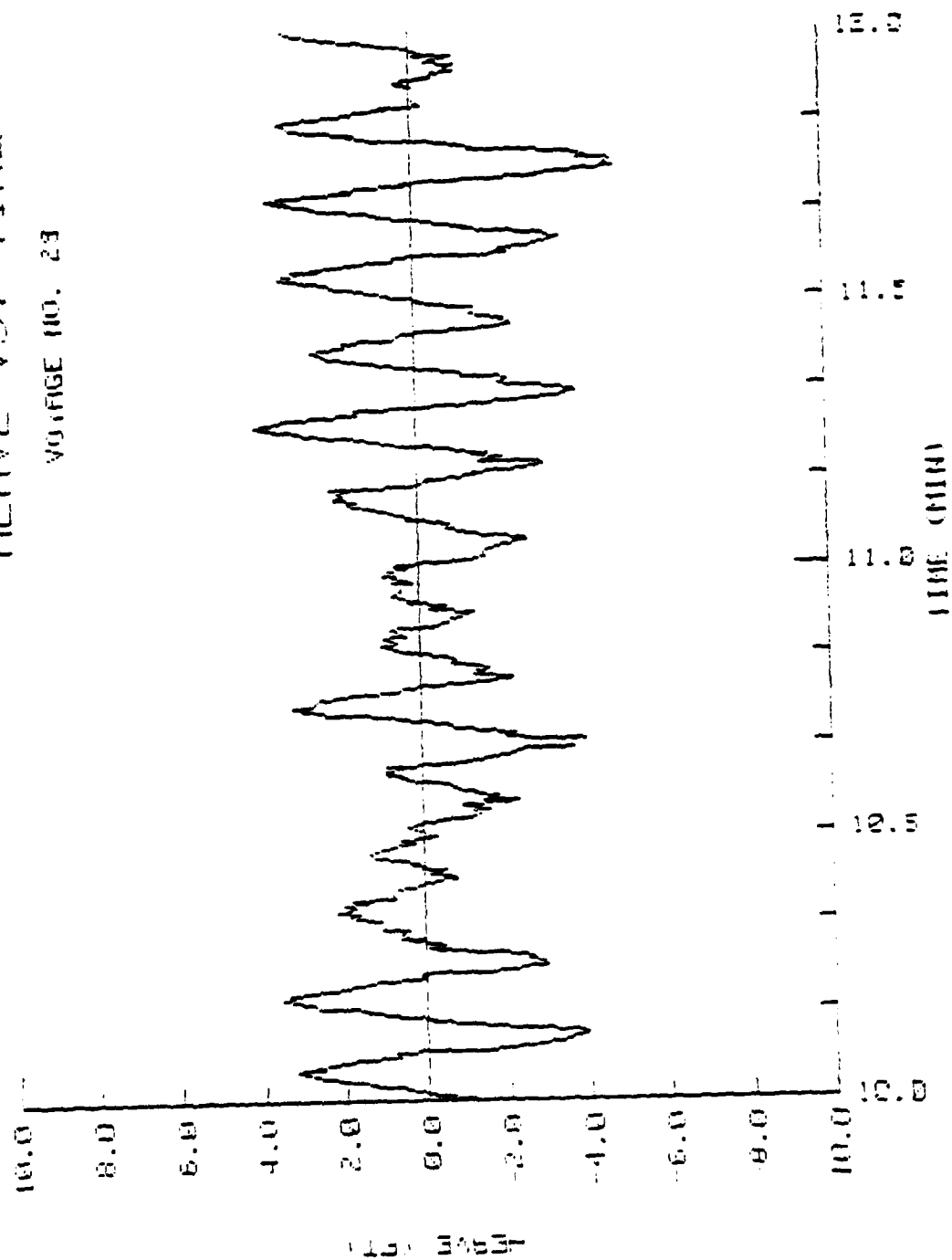
VOLUME NO. 29





# HEAVE VS. TIME

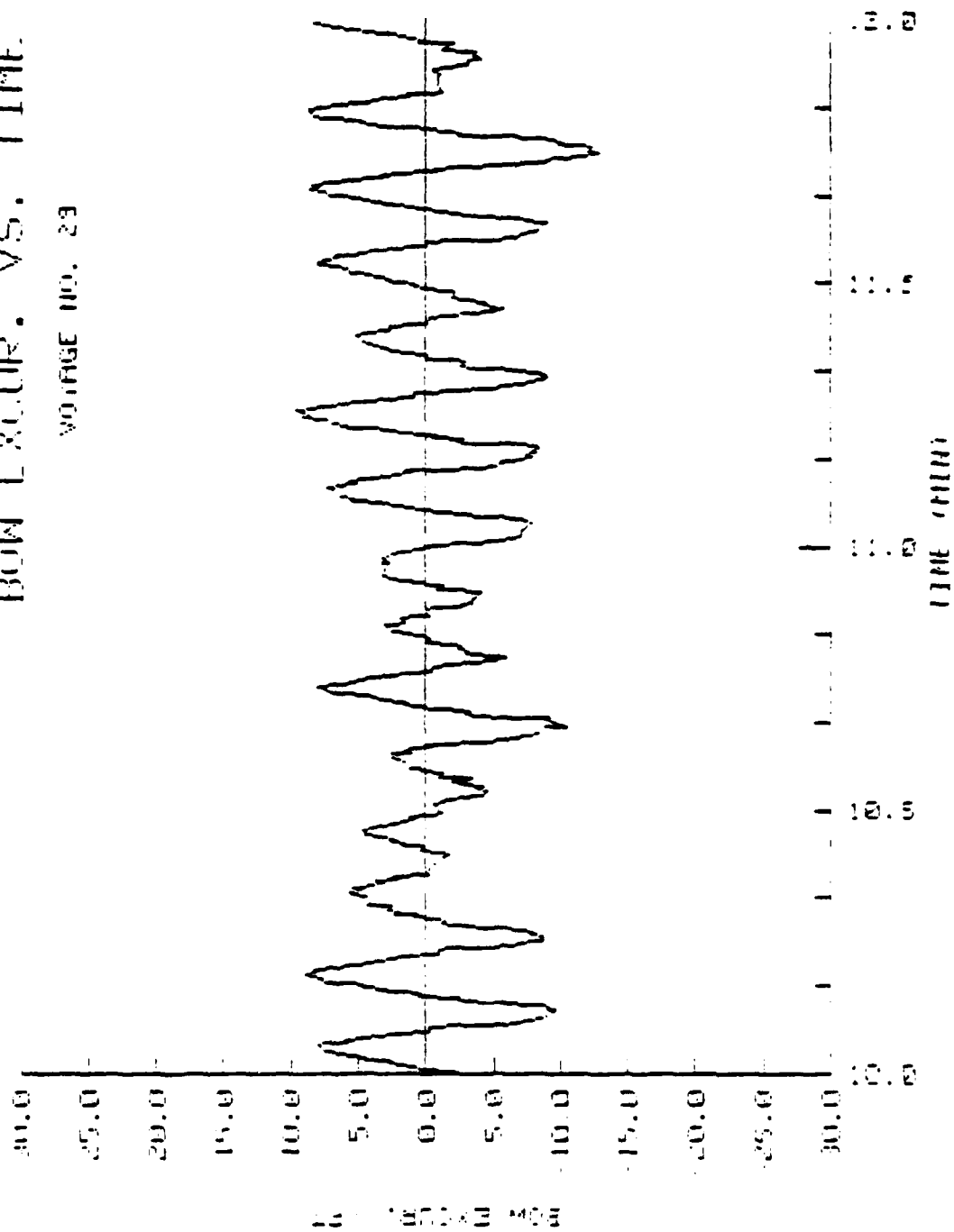
VOL. NO. 23





# BOM EXCUR. VS. TIME

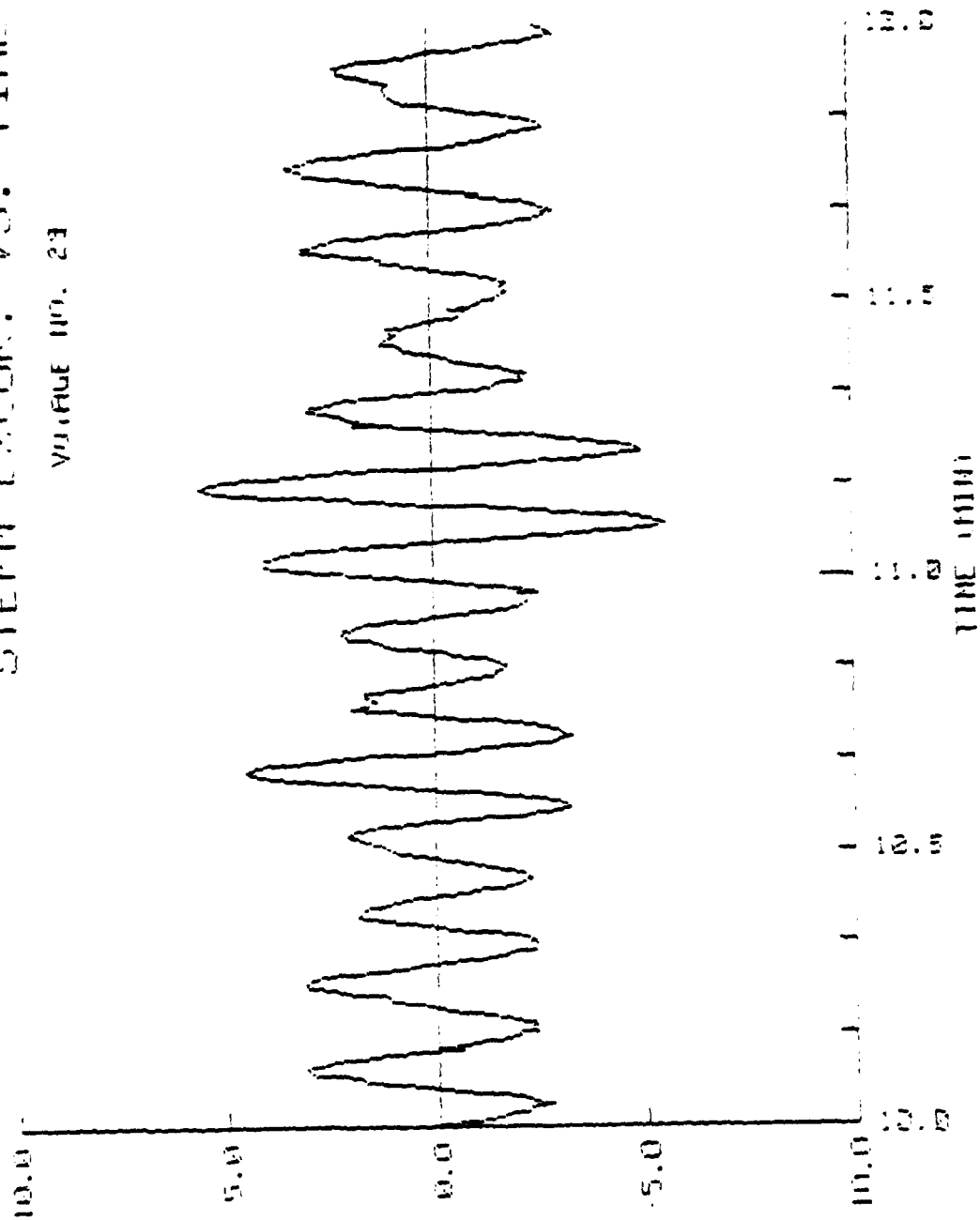
VOYAGE NO. 29





STEPH LECUR. VS. TIME

VOLUME 110. 23

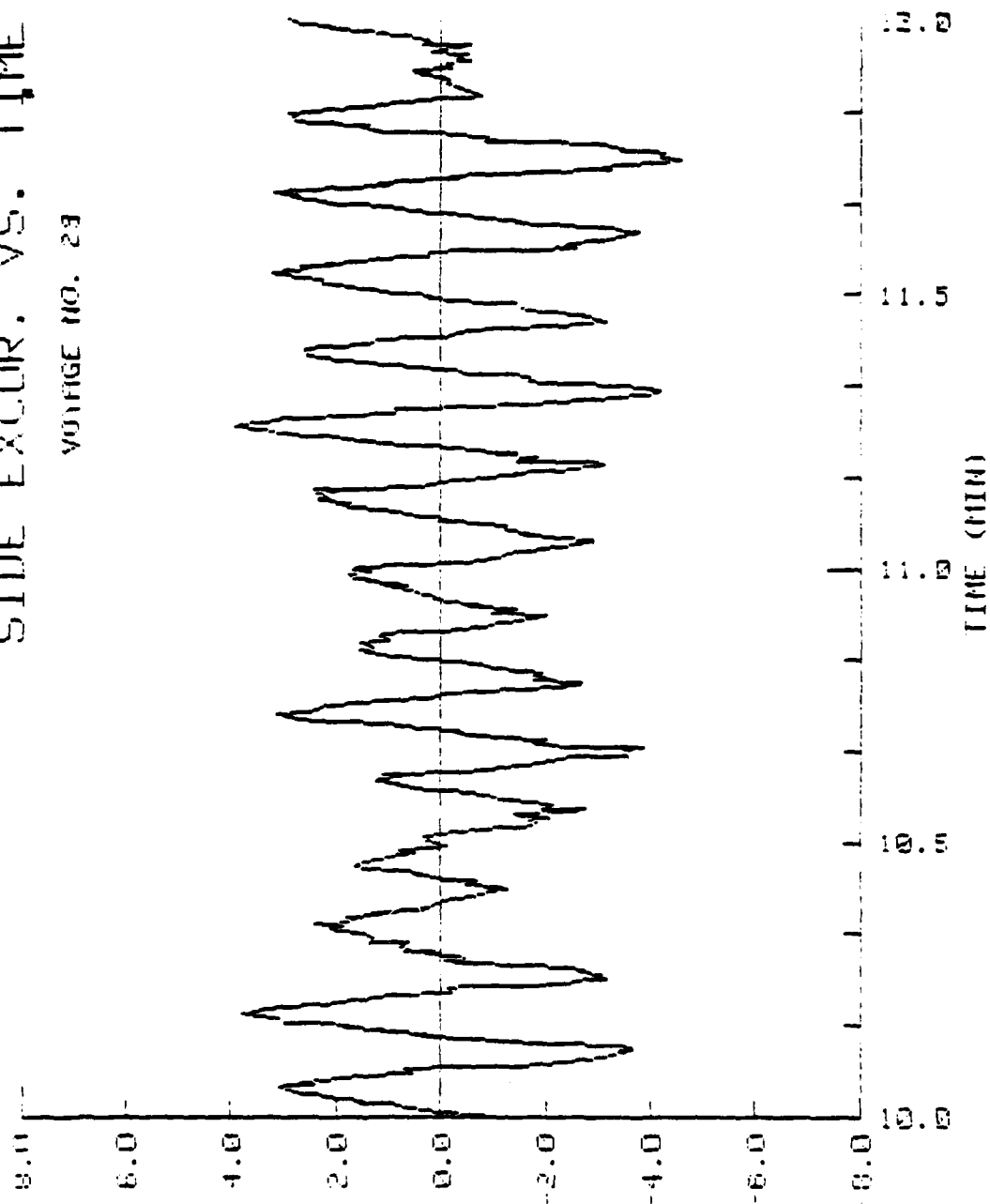


STEPH LECUR. VS. TIME



SIDE EXCUR. VS. TIME

VOLUME NO. 23



SIDE EXCUR. (V)



DATE  
FILME